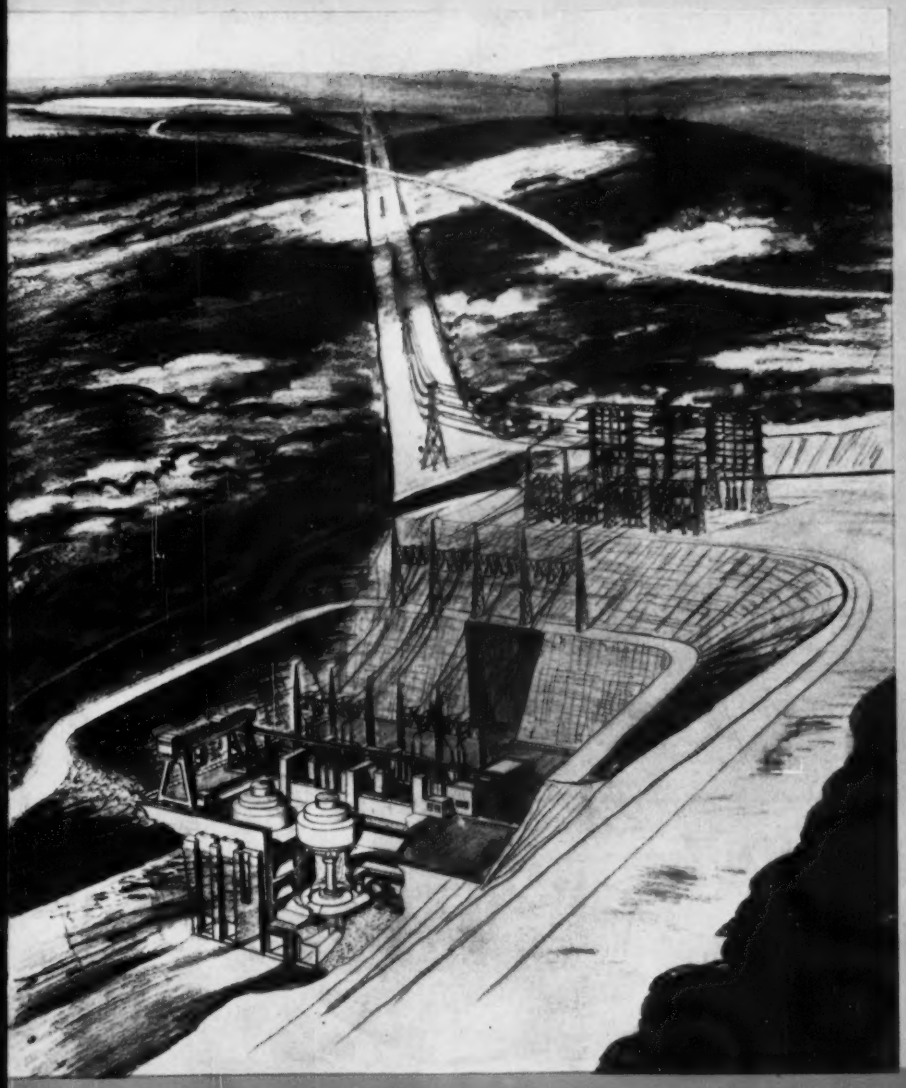
The Electrical Industry's Weekly Magazine

May 8, 1961

Electrical World

Price 50 Cents

A McGraw-Hill Publication



'Lean Project' Concept Key to Taum Sauk Economies...

...page 50

Accounting Steps Can Raise Income

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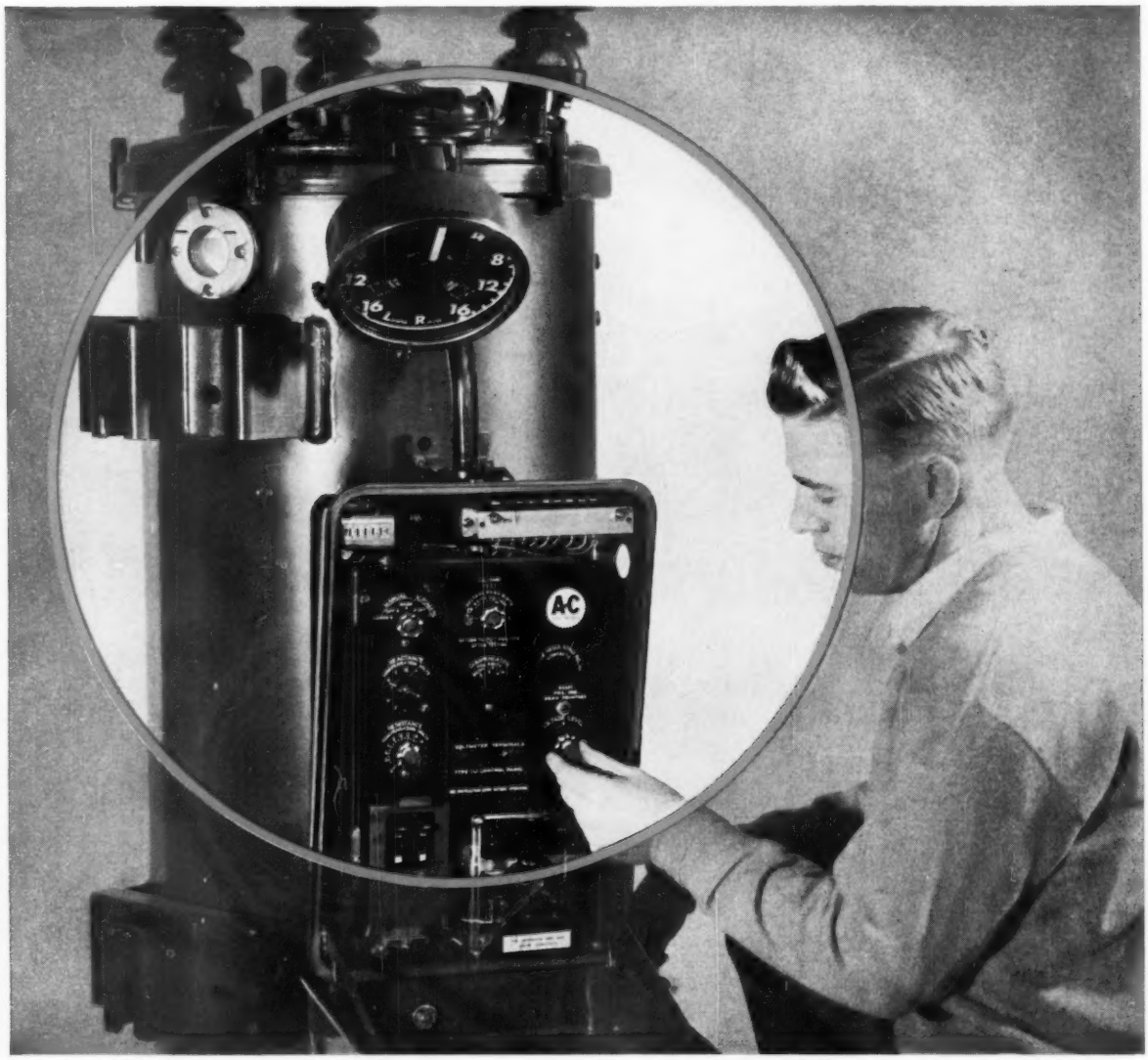

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Electrical World

May 8, 1961
Vol. 155, No. 19

Dateline . . .

Who Is Being Doctrinaire About Federal Power?

Washington, D. C.—Ask any one of the top Democratic officials at the Interior Department whether he would go down the line for federal power to the exclusion of investor-owned power, and he would deny that he was wedded to such an idea.

"I am not doctrinaire in this view," Interior Secretary Stewart Udall told a Senate Committee at his confirmation hearing. "I think again we approach each particular problem with an open mind."

Interior Undersecretary James K. Carr would probably take a similar tack. He has been described as a public power advocate, "but not a crusading one."

Assistant Secretary Kenneth Holum is a little more restrained in denying a doctrinaire view. Asked if the federal government should build transmission lines in areas where investor utilities are willing to build them, Holum answered:

"It is a matter of economics. If we can increase the return to the federal government by constructing federal transmission lines—and this is tremendously important to protect the payout of these projects—then I think the government should build them. If the economics are the other way, the situation is different."

Among the newly-appointed Interior Administrators, Bonneville Power Administrator Charles F. Luce appears to be most solidly in the non-doctrinaire camp. In his first public statement after taking the BPA post, Luce said: "I hope that Bonneville can play an important part in developing cooperative relationships with private business and with all public agencies in the resource field."

These mainly are excerpts from the public statements of the new Interior officials. They almost make a fetish of denying any hard and fast commitment to a strict federal power doctrine.

But in longer conversations with these officials, their own personal positions and views come through more clearly.

Secretary Udall, for instance, is likely to talk in terms of an "accommodation" between federal and

(*Continued on page* 5)

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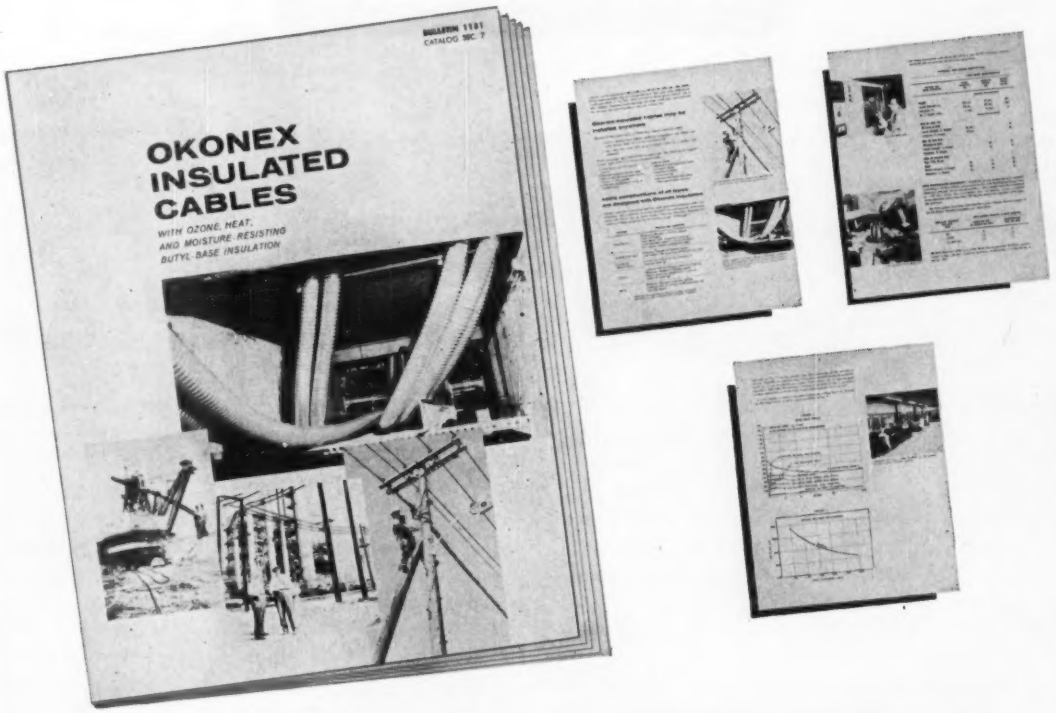

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Dateline . . .

Washington, D. C. (*Continued from page* 3)
investor power systems. In discussing construction or regional transmission systems, he is likely to say "We'll build some lines. The private utilities will build some lines. We are not selfish."

Then as if to further disassociate himself from any doctrinaire view of federal power, Udall will stress his desire to be practical. "We are not going to carry out our policies to the point of impracticality. We are going to approach these matters in a reasonable way and find the best way to implement them."

There is no lack of firmness in Udall's voice, but there is a tone of reasonableness.

Sit down with Undersecretary Carr, and the approach is a bit different. He is likely to say, more in sympathy than in anger, that the investor-owned always come in too late. He will recount two or three specific examples to bolster his point.

Carr is likely to tweak the investor utilities for "mistakenly believing they are in a competitive business like other industry," and assert that they exist as regulated organizations to serve the needs of their customers.

But the Undersecretary will tell you that he hopes that actions taken by the Interior Department will also benefit the investor utilities, and there is plenty of work in the power field for both public bodies and investor utilities.

Some of the air of reasonableness vanishes in the presence of Interior Assistant Secretary Holum. He told a Farmers Union audience recently, "We do have responsibilities to the patrons—individual and otherwise—of cooperatives, municipal, and public electric distribution systems. We intend to meet them to the best of our ability."

Holum generally makes only a passing reference to cooperation with investor utilities. He has talked with investor utility executives, but there has been no indication that he gave their views much weight.

Letters

Street Lighting in Australia

To the Editor:

My attention was recently directed to a street and highway lighting conference conducted in Chicago during October of last year. It was further mentioned that the conference was co-sponsored by *Electrical World*.

The lighting of this city's (Adelaide, South Australia) streets, roads through parklands, etc., has been under review during the past few years and improvements have already been effected in several localities. However, additional areas are currently being considered and, having regard to this, it would be very much appreciated if any papers presented at the conference held in Chicago, or record of proceedings of the conference, could be made available to me.

If you are not in a position to forward these yourself, perhaps you could advise me where they might be obtained.

G. A. Mudie, City Engineer
Adelaide, South Australia

▶ Copies of the conference papers have been sent as requested. Sets of the papers are still available from *Electrical World* at nominal cost.

Shed a Tear for 'What in World'

To the Editor:

I am sorry that you have decided to discontinue "What in the Electrical World."

In picking up your magazine, I would first read your up-front column. This would get me in the proper frame of mind to proceed with the further perusal of your magazine.

Somehow those few short paragraphs added a human touch which made me feel that everyone connected with the publication was interested in my welfare and had a personal message for me.

W. N. Rieger
Jackson, Mich.

ELECTRICAL WORLD
Vol. 155, No. 19 May 8, 1961

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. **Executive, Editorial, Circulation and Advertising Offices:** McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed in Albany, N. Y.

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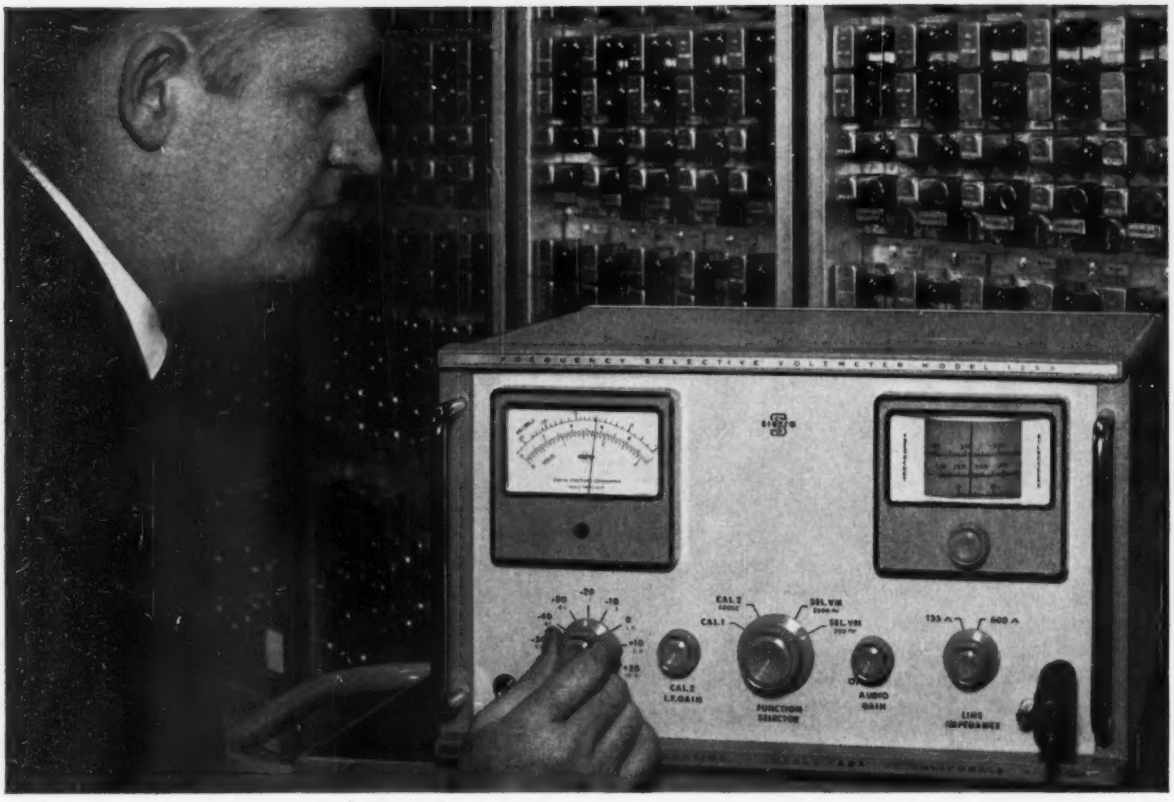

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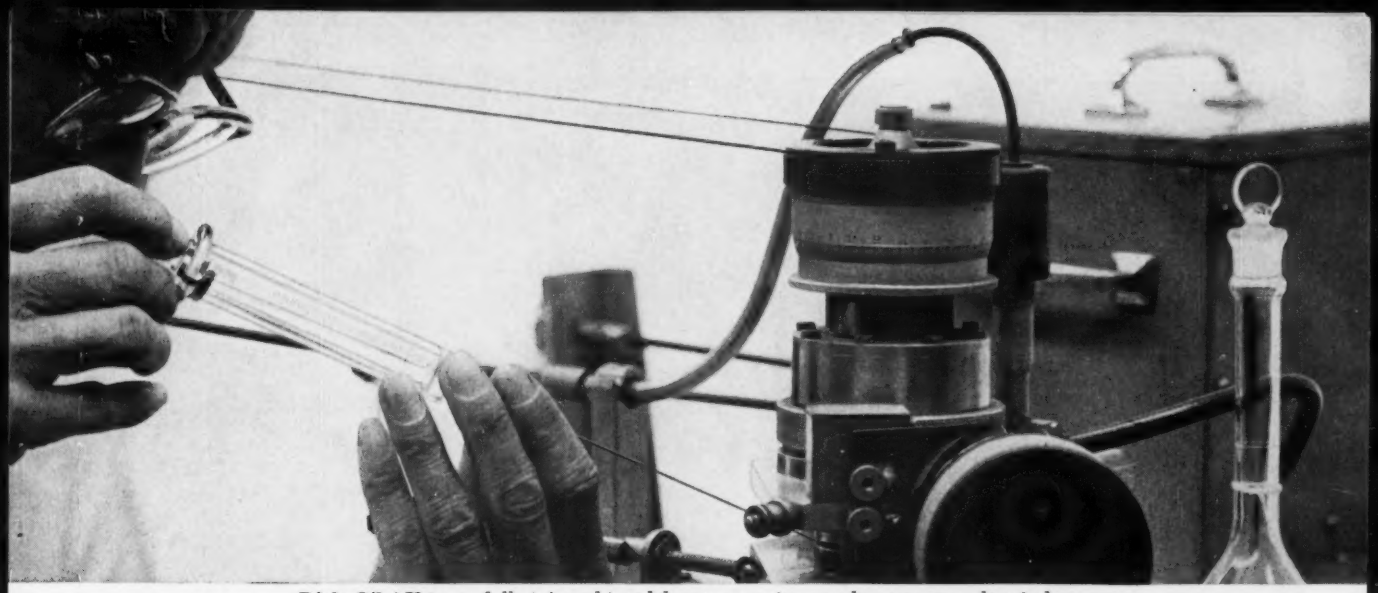

Diala Oil AX is carefully injected into laboratory equipment that measures electrical properties of the oil. This is one of the ways Shell makes sure that dielectric strength is high.

BULLETIN:

Shell reveals how Diala Oil AX lasts up to 5 times longer than ordinary oils

Only an oxidation-inhibited transformer oil of exceptional quality can be expected to give long service life under today's severe operating conditions.

That's why a growing number of utilities are switching to Shell Diala Oil AX. Read how Diala® AX helps them hold costs down—and how it can do the same for you.

THE DISTRIBUTION transformer is of constant concern to most utilities. It often operates outside its rated capacity during peak periods. Temperatures run high. And transformer maintenance costs are on the rise.

All of these factors have prompted utilities to search for a stable transformer oil that can help protect overloaded equipment, extend transformer life and reduce maintenance.

The answer for many utilities: Shell Diala Oil AX.

What Diala does

Diala AX contains a special Shell-developed oxidation inhibitor.

Accelerated laboratory oxidation tests show that Diala AX can provide satisfactory service *up to five times as long as* uninhibited oils.

Because of the oxidation inhibitor in Diala AX—and also because of Shell's selected base stocks and refining techniques—this remarkable transformer oil is exceptionally stable. It resists sludge formation. It helps prevent the creation of metal-attacking acids. And it reduces peroxide build-up which can damage many types of insulating materials.

Diala AX has also demonstrated an ability to extend the life of fabric insulation materials. In Shell's Emeryville, California laboratory, scientists soaked cotton insulating threads in many different oxidized oils—and for varying periods.

Conventional oils, when oxidized, weakened the thread by 25 to 40%. When subjected to the same oxidizing treatment, Diala AX had negligible effect on the thread's strength.

Diala AX has excellent dielectric properties (see photo above), good heat transfer characteristics and a very low pour point. Its low volatility reduces evaporation loss. And its flash point is high for maximum safety.

Call your Shell Representative

Ask your Shell Industrial Products Representative for all the facts on Diala AX. Or write: Shell Oil Company, 50 West 50th Street, New York 20, N.Y.

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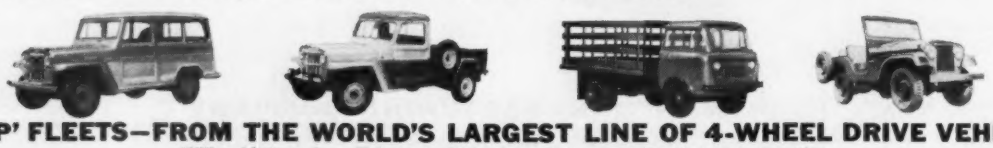

'JEEP' FLEETS—FROM THE WORLD'S LARGEST LINE OF 4-WHEEL DRIVE VEHICLES

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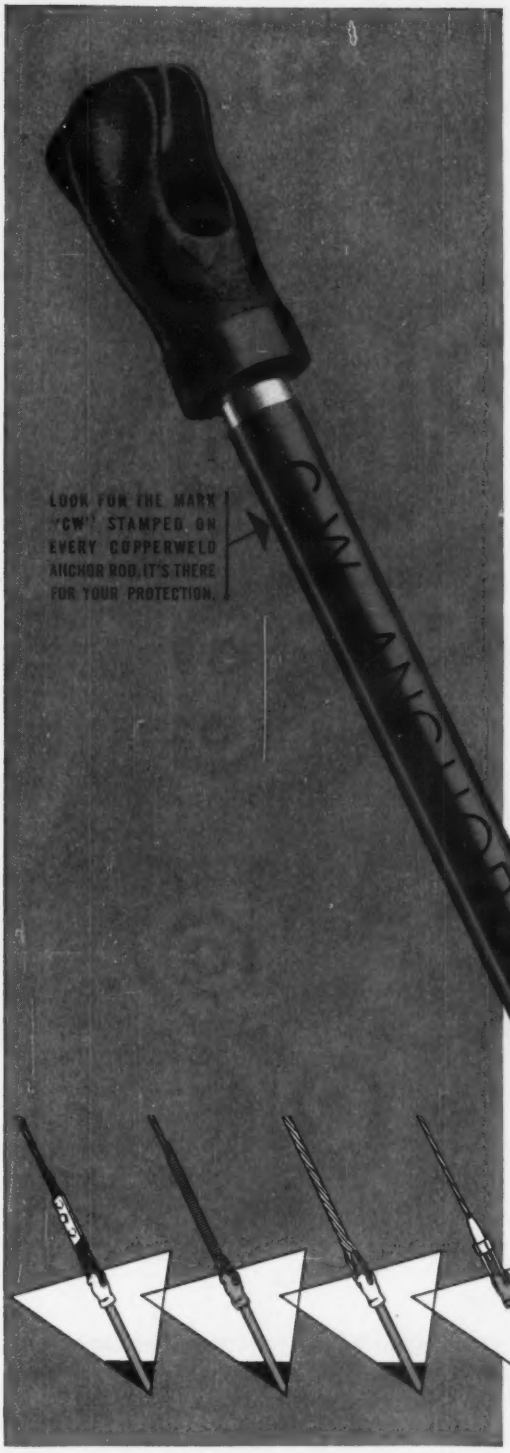

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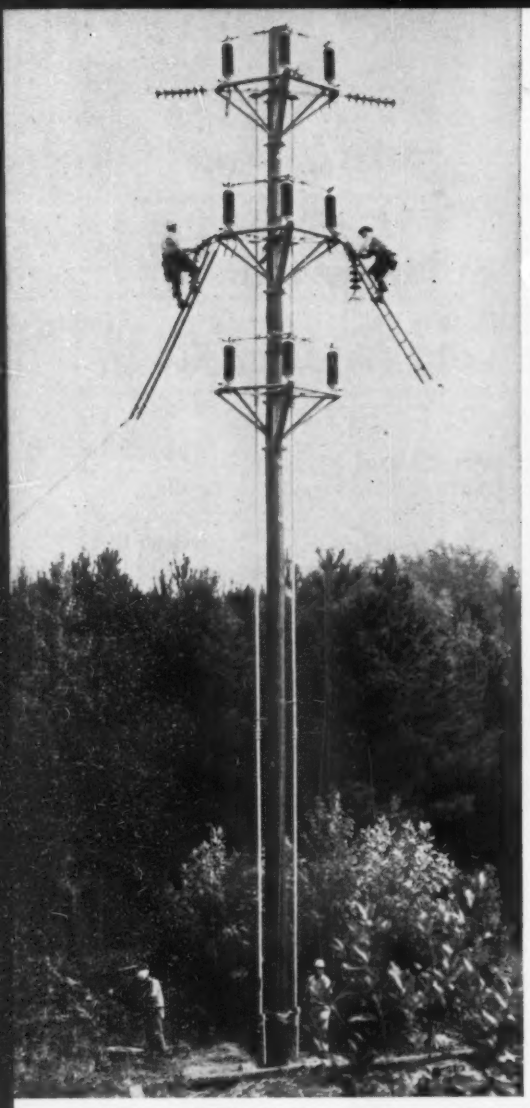
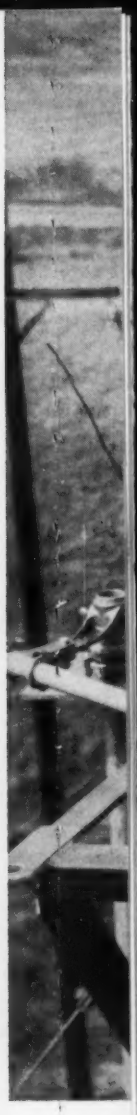


MINIMUM CREW TIME is needed to install Southern States Pole-Pak Air Switches. One pole is all that's needed for three-way switching, compared with conventional arrangements requiring up to six poles. Limited land requirements offer opportunities for installations where other types are not possible. Savings can be substantial.

EXCLUSIVE MOUNTING SYSTEM SPEEDS ERECTION OF SOUTHERN STATES' POLE-PAK



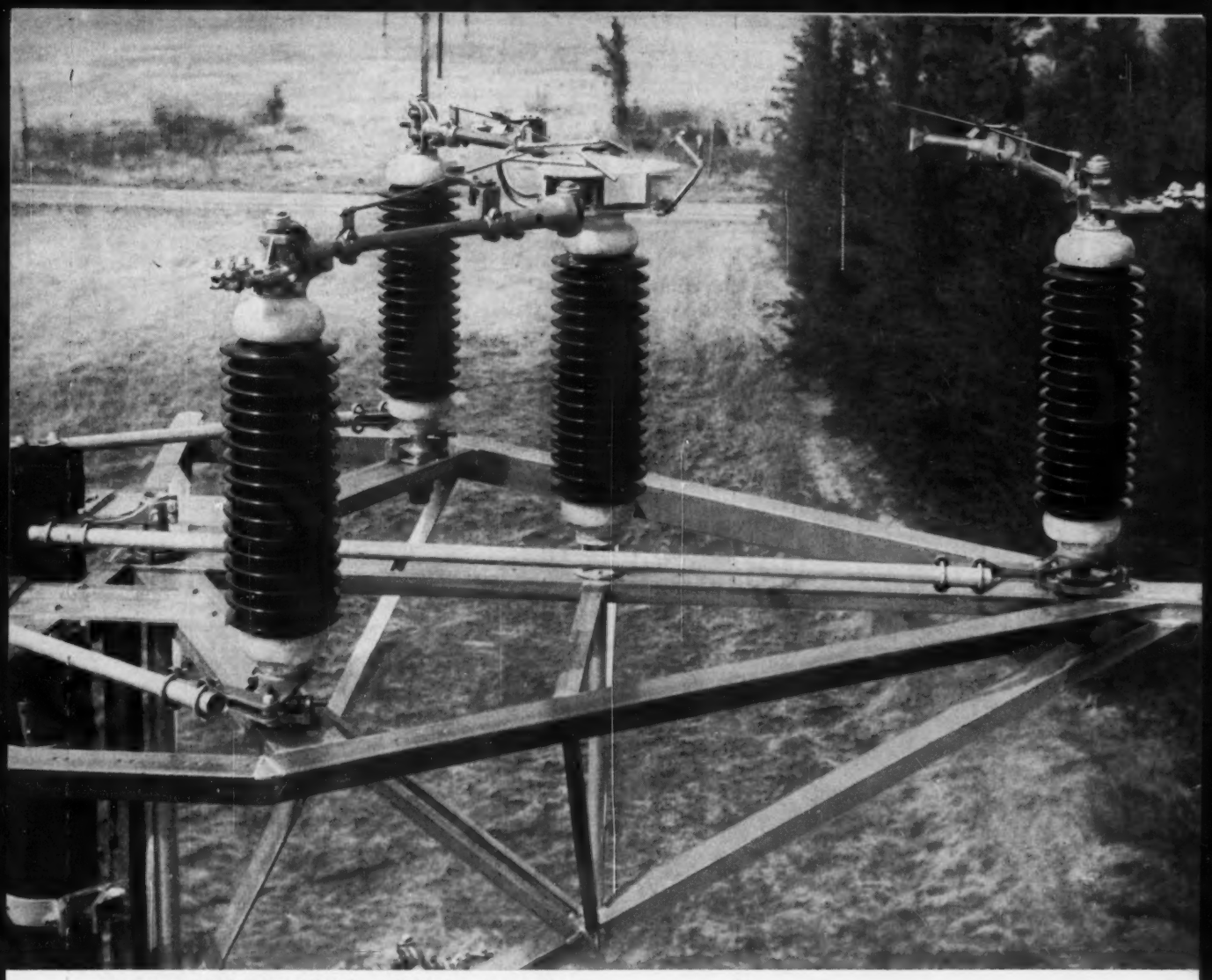
There are many outstanding mechanical and operating features of Southern States Pole-Pak phase-over-phase air switches. But the speed and ease of installation are particularly outstanding advantages.

Southern States employs an exclusive, simplified mounting system. Clamp-type steel bands are fastened to the pole at pre-determined positions. No gaining or drilling is necessary, assuring longer pole life. All switch units are assembled on the ground and hoisted into position. Hooks on the switch frame slip over a mounting plate on the top band, providing temporary suspension and automatically lining up mounting holes for quick and easy permanent bolting. It's that simple!

Other Pole-Pak Features

The Pole-Pak uses Southern States Type 57L braidless air switches. These rugged switches are equipped with Amplitact® contacts, time-proved as the most dependable means devised for handling high short currents.

The Southern States 57L switch is unusually easy to operate. Its blade is designed to toggle into the closed position and has no tendency to open. No force from the operating mechanism is needed to keep the switch closed. The switch is easily oper-



SOUTHERN STATES POLE-PAK is available in voltage ratings from 7.2 kv through 69 kv and continuous current ratings of 600 and 1200 amperes. One- two- or three-way models are available. Southern States Type 57L side-break braidless air switches with Amplitact® contacts are used in the Pole-Pak.

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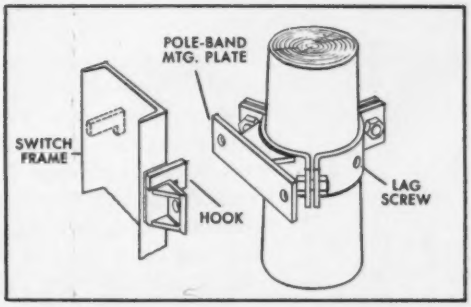
The Pole-Pak frame is constructed of 6061-T6 structural aluminum with adequate bracing for vertical angular pulls in addition to line tensions.

This phase-over-phase method of switching, employing only one pole, with its many time-saving and cost-saving advantages, warrants careful consideration.

Get full information from your Southern States representative, or write for Bulletin 61 PP.



SIMPLIFIED MOUNTING results from exclusive system. Steel band is clamped to pole. Two lag screws prevent slipping. Hooks on switch frame slip over pole-band mounting plate. No drilling or gaining of pole is necessary.

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SPECIAL HOLAN TEAM DEMONSTRATES LIVE LINE BARE-HAND TECHNIQUE

Coast-to-Coast Tour Provides Free Training

A two-man *Live Line Bare-Hand Team,* specially trained in the new bare-hand method of working on live high-voltage lines, is making a coast-to-coast tour of electric light and power utilities to teach safe practices, explain equipment and demonstrate the basic concept.

Holan Corporation — who pioneered the equipment used in the tests — has been granted the exclusive right to manufacture, sell and license the special metal shielding (patents applied for) used in the bare-hand method by its developer, H. L. Rorden, high-voltage practices engineer for the American Electric Power Service Corporation.

An executive of Holan Corporation with more than 20 years as a transmission and distribution specialist leads the team. He is accompanied by a veteran line foreman with 15 years as a lineman, troubleman and training instructor in hot line tools.

Using the bare-hand method, line repairs can be made without service interruption. Cumbersome tools and equipment are eliminated. The new technique offers greater safety in many cases than present practice. It has been field tested at 34.5-kv and 138-kv.

We urge you to make arrangements today to see the *Holan Live Line Bare-Hand Team* in action. To aid us in scheduling the team, please fill in and mail the coupon.

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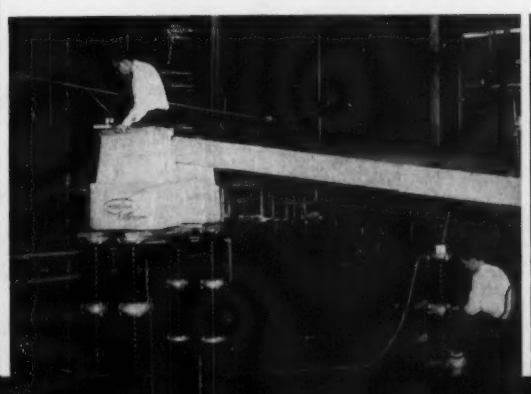
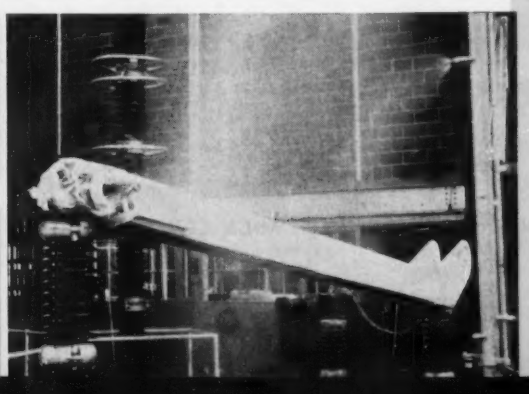
HOW IT WORKS Exceptional speed is possible with the live line bare-hand method. Working from an insulated Holan HV-50 Elbow, equipped with buckets lined with metal shielding which is connected to the hot line by clamps, the linemen are at the same potential as the conductor and no leakage current flows through them. In the main illustration, the linemen have backed away from the pole and other conductors to remove old insulator from 34.5-kv hot line to which they are connected. New insulator (left inset) is attached to conductor using ordinary hand tools. All movement of Elbow is controlled by three levers shown under lineman's elbow. The new insulator (right inset) is guided into place as men stay clear of the crossarm. After disconnecting the buckets from the conductor and lowering to convenient height, the nut is put on the insulator stud. Total time: ½ manhour — compared to 5 manhours by conventional method.

EXHAUSTIVE TESTING proved the safety of the upper arm insulation of the Holan HV-50 Elbow for field use in live line bare-hand maintenance. All testing was carried on in the High-Voltage Laboratory of the Ohio Brass Company by their engineers under the direction of Dr. Charles J. Miller, Jr., and H. L. Rorden, developer of the new technique. The Holan upper arm was thoroughly tested for interior and exterior leakage current, wet and dry flashover, and charging current. Below left, Dr. Miller (in bucket) and a lab technician are measuring charging current from the energized conductor to screenlined bucket and along a fiberglass tube to ground. Below right, simulated rain is used in wet flashover tests of the Holan upper arm insulation.





HOLAN CORPORATION
4100 West 150th Street • Cleveland 35, Ohio

We would like to attend a demonstration/training session of the Holan Live Line Bare-Hand Team when it is in our area. Approximately_____ of our employees would attend the demonstration.

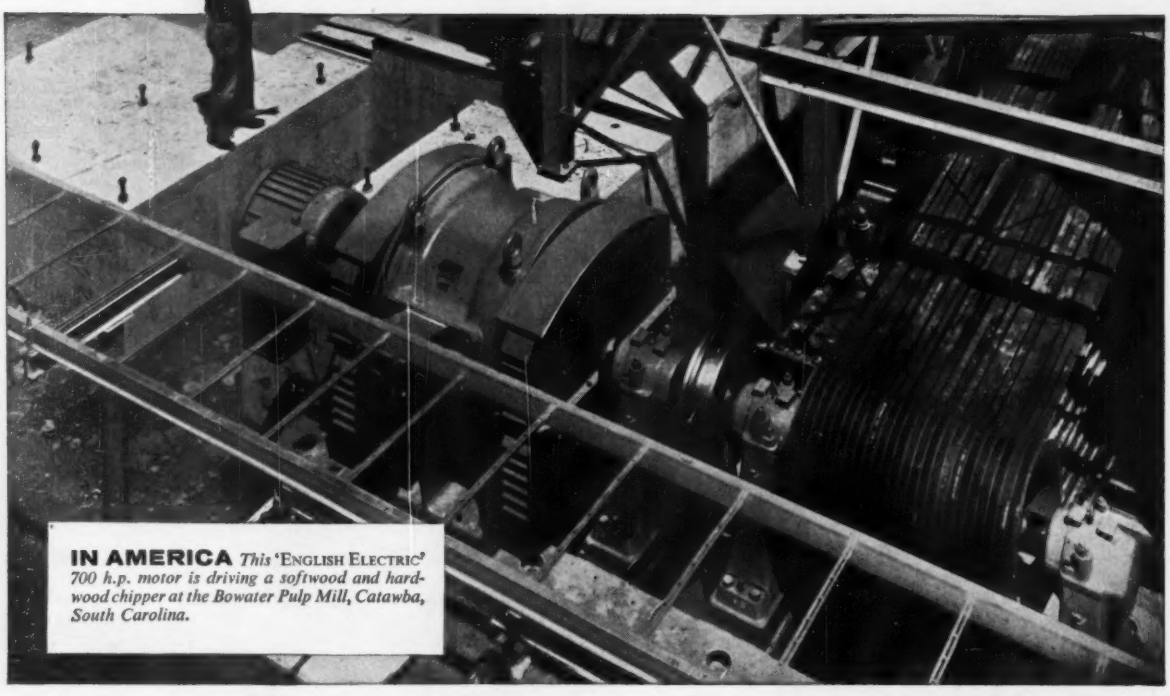
NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____

"Start her rolling!"

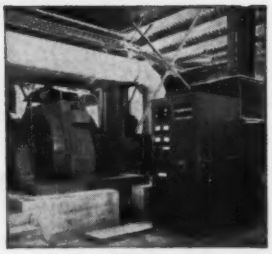


IN AMERICA *This* 'ENGLISH ELECTRIC' *700 h.p. motor is driving a softwood and hardwood chipper at the Bowater Pulp Mill, Catawba, South Carolina.*

Throughout the world new 'wheels' of commerce start rolling. At Catawba, near Rock Hill, South Carolina is the latest pulp mill of the Bowater organisation. Here 400 tons of sulphate pulp (the valuable strengthening element in most forms of paper) is produced from each day's consumption of 800 cords of pine.

Drive motors for use in various processes were supplied by 'ENGLISH ELECTRIC'. These motors range from 250 to 1,000 h.p. and are used for driving pumps, fans and chippers.

Motors, designed and manufactured by 'ENGLISH ELECTRIC' ranging from 68,000 h.p. wind tunnel compressor motors to fractionals for domestic appliances, serve industry, commerce and the home in almost every country of the world. Wherever power is used or needed 'ENGLISH ELECTRIC' is ready to generate it, distribute it and put it to use. Work on any location is backed by a worldwide organisation with factories in five continents.



IN THE PHILIPPINES

An 'ENGLISH ELECTRIC' *1,320 h.p. synchronous induction motor and control cubicles driving a ball mill at the Republic Cement Corporation Plant, Manilla.*

IN SOUTH AFRICA

Six of the 44 'ENGLISH ELECTRIC' *2,100 h.p. salient pole synchronous motors driving water drainage pumps 5,400 feet below ground in a South African Gold Mine.*

'ENGLISH ELECTRIC'

Agents: ENGLISH ELECTRIC EXPORT & TRADING CO. LTD., 750 THIRD AVENUE, NEW YORK 17, N.Y. Telephone: MURRAY HILL 7-0303

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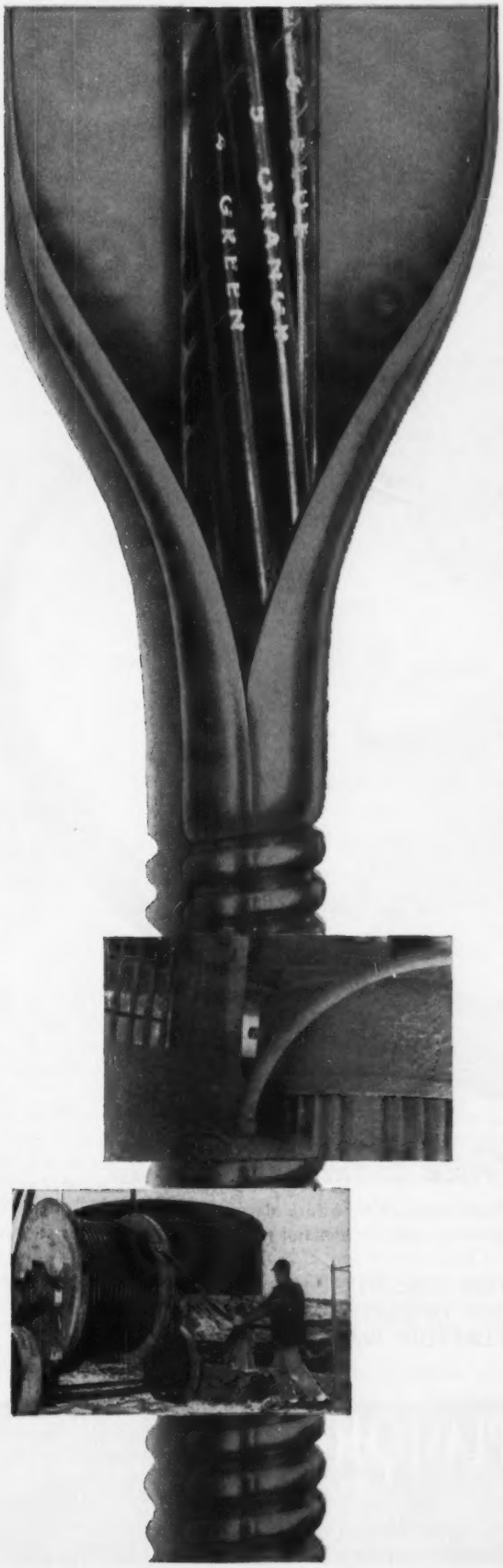

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Sealed Cable Systems by Simplex Can do so Many Jobs so Well

Simplex C-L-X is a packaged combination of cable and an extremely pliable, corrugated metal sheath. It requires no separate duct or conduit regardless of environment. It is available with steel sheath and plastic jacketing; and with copper or aluminum sheaths, with or without plastic jacketing.

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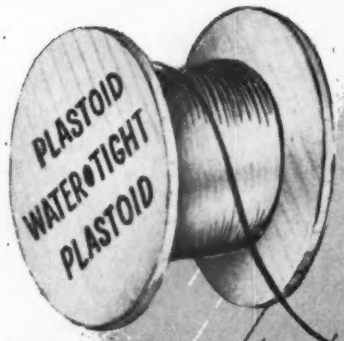

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Overcomes the problem of leads acting as a pipeline to feed water or moisture to the electrical devices to which they may be hooked-up.

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Free Samples **ON REQUEST**

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"Manufactured by the mile
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Plant: HAMBURG, N. J.

You get more value for the same dollar— in the NEW Bulletin 709 line of starters!

Note the compactness of both the smallest and largest starter in the new Bulletin 709 line. Ratings up to 100 hp, 220 v; 200 hp, 440-550 v.

This new line of Allen-Bradley motor control will change every idea you have had about starter size, performance, and life. The small size—especially in the higher ratings—is startling. Yet rating for rating the operating life and reliability have been increased many times. Built into each of the seven sizes of this new Allen-Bradley line is an ability to interrupt tremendous currents and to operate year in and year out for many millions of operations without trouble or maintenance.

The new Bulletin 709 starters are just as advanced in appearance as they are in performance. All seven sizes have an aristocratic styling and a distinctive family likeness. Brooks Stevens, famous industrial designer, has given the enclosures such an attractive, modern style that these new starters will prove a distinct sales asset on any machine or installation.

Why not write today for more information on this revolutionary new line of Allen-Bradley Bulletin 709 *quality* across-the-line motor starters?

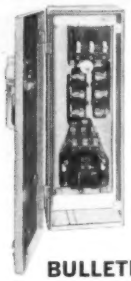
12-61-6M

ALLEN-BRADLEY

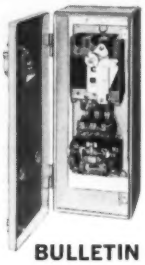
Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

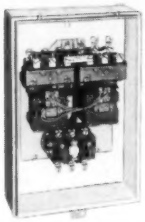
QUALITY MOTOR CONTROL



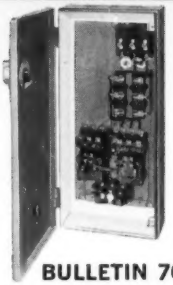
BULLETIN 712
Size 1 combination starter with fused disconnect switch



BULLETIN 713
Size 1 combination starter with circuit breaker

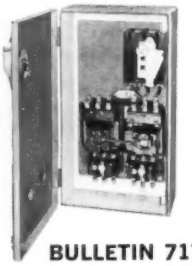


BULLETIN 705
Size 2 across-the-line reversing starter with overload relays

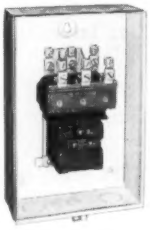


BULLETIN 706
Size 1 reversing starter with fused disconnect switch

BULLETIN 715
Size 1 across-the-line, multi-speed starter with overload relays



BULLETIN 717
Size 2 multi-speed starter with circuit breaker



BULLETIN 702
Size 3 three-pole, a-c solenoid contactor

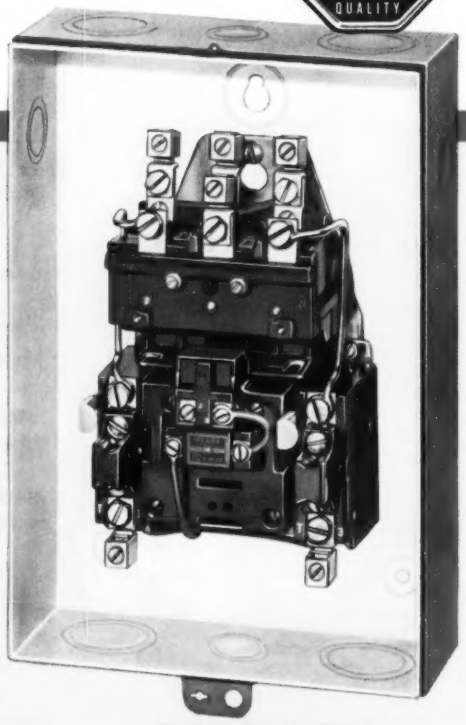
Pygmies in Size
Giants in Performance—
the NEW Allen-Bradley Across-the-Line Starters!

This new line of across-the-line motor starters is the result of over 30 years of experience and leadership in the motor control field.

While retaining the simple solenoid principle—with only ONE moving part—these starters are completely new in every way. They are amazingly small in size—yet test after test has proved they will not only outperform but also outlast any starter now on the market. They are good for *many millions* of trouble free operations. All have scores of design refinements that make them easier to install and maintain. All are available in the smart new enclosures designed by Brooks Stevens. They make a beautiful addition to any machine or control installation.

You'll want to get the complete story about these truly revolutionary new across-the-line starters. Write for new Publication 6100.

A-B QUALITY



BULLETIN 709

This popular across-the-line solenoid starter shows the new Size 2 construction. Note the white interior and generous wiring space. Bulletin 709 starters are available, in the new construction, in seven sizes—Sizes 00 to 5, with a maximum rating of 100 hp, 220 v; 200 hp, 440-550 v.

12-61-RM

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QUALITY MOTOR CONTROL

Electrical World

MAY 8, 1961
Vol. 155, No. 19

Preview of the Issue

DEPARTMENTS

Editorial Comment..... 41
Dateline 3
Letters 5
Electrical Week..... 22
Supply Lines..... 23
EUM 56
Today's Design Trends.. 58
Manufacturers News..... 60
Management Newsletter.. 73
New Equipment..... 81
Selling 82
News About People..... 86
Meetings Calendar..... 96
Advertising Index 96

● **'FEDERAL LEADERSHIP' CAN BE PATHFINDER to greater, more complete public power system if public power only 'thinks big,' APPA hears as it discusses interconnected power pools..... 42**

● **'LEAN PROJECT' CONCEPT is key to decision in favor of pumped-storage for Taum Sauk which will provide 350 Mw of peaking hydro..... 50**

● **SCREW ANCHOR gives cheaper, faster semi-buried distribution, minimizes digging, and eliminates concrete slab in providing firm transformer mounts at residential developments 54**

CURRENT EVENTS

KEFAUVER SEES CONFLICT between GE Vice President Vinson's testimony and that of others at Senate antitrust hearings. Meanwhile, former Vice President Ginn denies GE top brass knew of price fixing..... 45

NEW HIGHS ARE PREDICTED for this year's output and generating capacity. Edison Electric Institute power survey covers trends of five and 16-year periods leading up to 1964..... 46

DATELINE

WHO'S DOGMATIC ABOUT FEDERAL POWER? 'Not me,' flatly says each of the men at Interior, but a closer look reveals their attitudes more clearly..... 3

ELECTRIC UTILITY METHODS

FAULT CURRENTS are quickly spotted by dc board which simulates utility's system. Board cuts need for computations usually associated with the operation..... 56

INTERNATIONAL

RULES AGAINST PASSAMAQUODDY: International Joint Commission reports tidal project is not economically feasible..... 44

MANAGEMENT

UTILITIES CAN BOOST INCOME by adopting six techniques designed to tighten accounting procedures and keep dollars from slipping away..... 73

CUSTOMERS WERE NOT OVERCHARGED or 'damaged' by antitrust conspiracy, asserts supplier's study . . . Kennedy moves against identical bids..... 23

MANUFACTURERS NEWS

TRANSFORMER NOISE IS CUT by 'uncoupling' vibration-energy-conducting paths . . . Hanford generators could produce steam to serve 700-Mw electric generating facility..... 60

MEETINGS

WE'VE BEEN OUTDONE on Columbia, many Canadians feel. Speedy US ratification of pact (and resulting Canadian suspicions) coupled with confusion over benefits augur a delay in Canadian confirmation, Northwest Public Power Assn hears..... 47

R&D CAN REDUCE COST of underground construction. Increasing public interest in U/G distribution also lies ahead, speaker tells Pacific Coast Electric Assn meeting..... 48

TODAY'S DESIGN TRENDS

TWO SOURCES OF PHOTOCELL FAILURES are exposed by Philadelphia Electric tests..... 58

SOLID-STATE DEVICE with 50-kva capacity converts dc to ac..... 59

NEXT WEEK

STRUCTURES ARE DEVELOPED for distribution boost to 23.9 kv.

The Electrical Week

FUTURE NEWS ▶ **An affirmative vote** by the Senate on Joseph Swidler and Howard Morgan as FPC commissioners can be expected May 17 on the basis of Senate Commerce Committee hearings concluded last week. They are President Kennedy's nominees and little negative information has been brought out.

LATE NEWS ▶ **Bureau of Reclamation rejects 14 out of 16 bids** on transmission line materials because they are identical. Floyd Dominy, Reclamation Commissioner, says 19 companies respond to two invitations worth about $1,250,000. Dominy says new invitations will be issued soon with an anti-collusive clause inserted. Materials are for Central Valley project, Calif., and Upper Colorado River Storage project.

Technicalities give US Supreme Court a hard time during oral arguments of the Enrico Fermi nuclear power plant case. Power Reactor Development Corp and AFL-CIO unions carry out battle in highly technical language as arguments on safety are brought before the Court. Ruling is expected this fall.

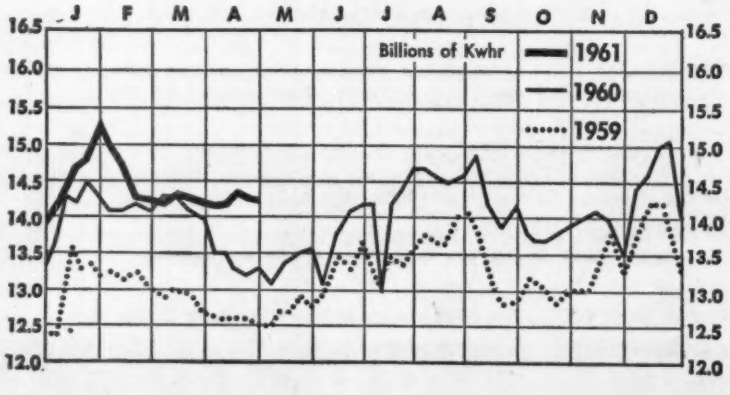
Ex-President Eisenhower's appointee, E. Barrett Prettyman, is named to head new Administrative Conference of the United States which has responsibility to review administrative practices and make recommendations. Joseph P. Healy, VP and general counsel of Boston Edison Co, is member of the 11-man group. Also serving is James Landis, President Kennedy's assistant on regulatory matters.

Economics of marketing power from proposed Rampart Dam in Alaska will be studied by Development & Resources Corp, New York, under contract awarded by Corps of Engineers, Alaska district.

Investor-owned utilities are blasted as ". . . these obstructionists . . ." by Reclamation Commissioner Floyd Dominy at dedication of Fremont Canyon power plant and Gray Reef Dam in Casper, Wyo. Said Dominy: "I am afraid some of you have been misled by a fraudulent bill of particulars put together by some segments of the private power industry—an industry which has long cried gloom and doom concerning federal hydro power development." Leroy Patterson, VP of Public Service of Colo., also a guest, said afterwards: "It's just not true and we can prove it." And D. R. McLung, president of Pacific P & L, told Dominy after the speech: "Our conscience is completely clear. I don't understand this attack on the power industry. We have always supported multipurpose federal projects."

Weekly power output figures show April peak occurred in week of April 15. Pacific Northwest and South Central regional increases help hold the average up.

WEEKLY POWER OUTPUT—Up 4.4% (Week ending Apr. 29), Kwhr 14,254,000,000



Percent Change From Previous Year

	Apr. 15	Apr. 22	Apr. 29
Total U. S.	+ 6.0	+ 5.5	+ 4.4
New Eng.	+10.0	+ 8.1	+ 7.8
Mid. Atlan.	+ 8.1	+ 7.9	+ 4.5
Cent. Indust.	+ 2.3	+ 1.8	+ 0.8
West Cent.	+ 8.2	+ 8.1	+ 4.6
Southeast	+ 7.7	+ 6.6	+ 3.4
South Cent.	+ 2.6	+ 5.0	+ 8.3
Rocky Mount.	+ 8.1	+ 6.1	+ 5.1
Pacific			
NW	+ 2.4	+ 0.5	+ 4.5
SW	+10.4	+10.2	+11.8

Seasonally Adjusted Index 290

Week Ago 291 Year Ago 276

Source: Edison Electric Institute

Supply Lines

SUPPLIER RELEASES STUDY OF ELECTRICAL EQUIPMENT PRICES

A study of electrical equipment prices from 1954 through 1959 has been released by Allis-Chalmers Mfg Co. The report prepared from material supplied by Allis-Chalmers, General Electric Co, Westinghouse Electric Corp, and Ingersoll-Rand Co, is being sent by A-C to make certain of its utility and industrial customers. Presumably the three other manufacturers participating in the joint studies will also send out their own versions.

A-C says the 15-page report was prepared because customers "deserve to know the facts" on the question of damages which may have been sustained as a result of the antitrust conspiracies. It sums up the results of the study by saying that they "provide authoritative support for our statement that we believe our customers were not overcharged—or 'damaged.'"

Products involved in the study are steam turbine-generators, land steam condensers, large outdoor oil and air circuit breakers, metal-clad power switchgear assemblies, power switching equipment, and power transformers. The latter four are grouped together as "electrical equipment;" the first two are treated individually. Raw data for the study were the orders received by the participating companies from utilities and the government during the six-year period.

The A-C report compares price trends of the equipment with various trends in the price of materials, labor, and other types of machinery, some derived from government statistics, and some derived from company statistics. In all cases other than steam-turbine generators, the price index of the equipment involved in the antitrust cases was generally the same or below the comparable indices. In steam turbine-generators the price index is above the comparable indices after 1956. But the report then takes into account increasing turbine efficiency so that the final chart shows the increase in the "cost of generation" to have been only 2.7% during the six-year period.

PRESIDENT ISSUES ORDER TO DISCOURAGE IDENTICAL BIDS

President Kennedy is trying to discourage identical bids, but his brother, Robert, says the bids aren't necessarily bad. On April 25, President Kennedy issued an executive order to all government departments and agencies requiring them to report to the Justice Department any identical sealed bids worth more than $10,000. The President said the purpose of his order was to "discourage future submissions of such bids, aid in the enforcement of the antitrust laws and the maintenance of a competitive economy and serve to reduce the cost to the government."

On the following day, Attorney General Robert Kennedy said in an interview that the Justice Department is concerned with conspiracy and collusion, not prices. "I can conceive of a number of different instances," the President's brother said, "where you have identical pricing which wouldn't be illegal or improper."

POLE LINE HARDWARE, ANCHOR PRICES CHANGED

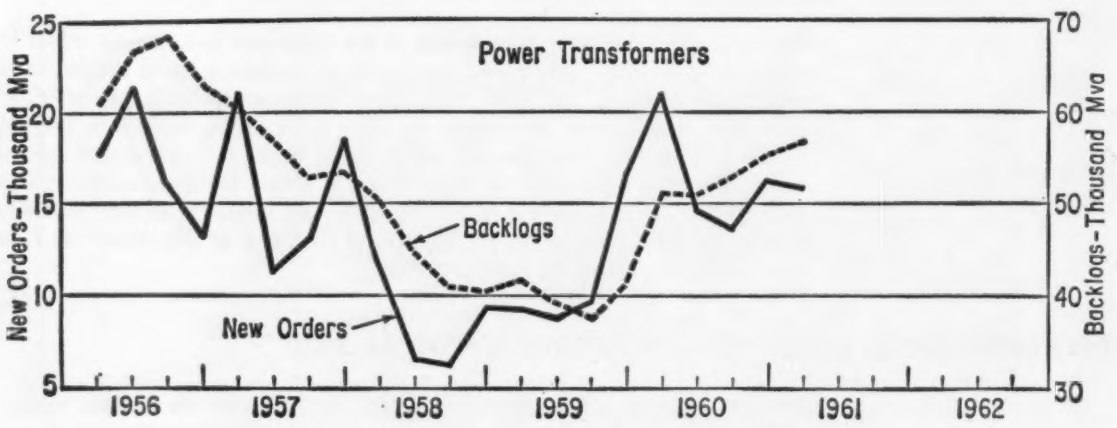
Changes in the price structure of two product lines will be made May 15 by A. B. Chance Co. In pole line hardware, the company says consolidation of its manufacturing facilities at its Centralia, Mo., plant has caused a re-evaluation of its

prices with the following results: (1) Removing from price sheets seldom-used items; (2) Reducing Zone 1 prices about 5 to 7% based on a study of "real costs;" (3) Eliminating Zones 2 and 3 so that all pricing east of the Rockies will be on the Zone 1 base, and which will amount to a "substantial reduction in the present prices" of Zones 2 and 3; (4) Continuing present price structure of Western Zones 5 and 6 as they are still under study.

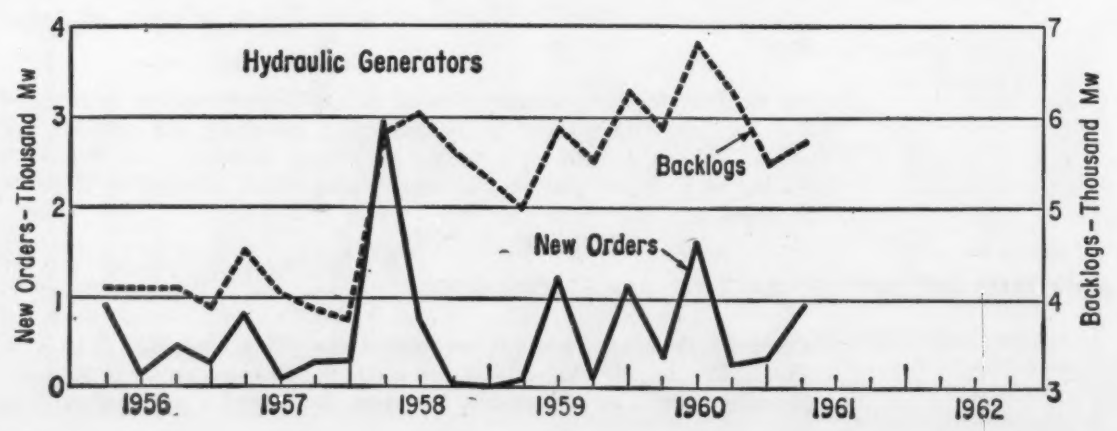
At the same time, the company says manufacturing economies are resulting in May 15 price reductions of about 10% on expanding anchors, and about 15% on 'No-Wrench' anchors, and will apply to both Eastern and Western Zones.

POWER TRANSFORMER BACKLOGS AT FOUR-YEAR HIGH

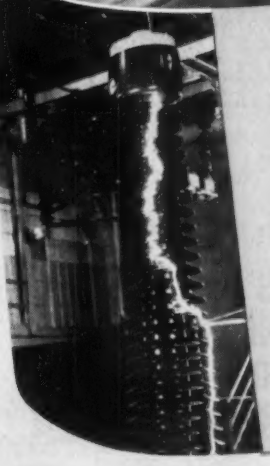
Manufacturers' backlogs of power transformers at 57,056 Mva, are now at their highest level since the middle of 1957, the Edison Electric Institute reports in its quarterly survey of the industry. Domestic new orders during the first quarter were 15,394 Mva, a little under the 16,102 Mva ordered the previous quarter. Export new orders were 582 Mva, bringing the total to 15,976 Mva.



First-quarter new orders for hydraulic generators totaled 966 Mw, of which 324 Mw were for export. Backlogs are at the 5,772-Mw level, EEI reports:



Ready for the future



O-B bushing experience, excellent facilities help Penelec energize new 460-kv system

Among the bushings supplied for Pennsylvania Electric Company's EHV project by Ohio Brass Company are three 460-kv, 1550-kv BIL, 800-ampere draw-lead bushings. Others include 115-kv, 23-kv, and 15-kv bushings.

You would expect flawless performance of the smaller bushings; O-B has been producing them for some time now. How about the new 460-kv bushings? What kind of performance do they promise?

These 460-kv bushings offer the same dependable performance as O-B's low voltage bushings. Although building commercial 460-kv bushings is not an everyday occurrence at O-B, designing, building, and testing extra-high voltage products have been going on for quite a few years. And, naturally O-B is proud to pour its know-how into this historic 460-kv project.

So, these new O-B bushings go into service for Penelec, a company who is planning for the future. May we suggest that you, too, plan the future confidently with O-B bushings - - bushings that are backed by nearly 50 years of experience. Specify O-B bushings to be sure you get them on your equipment.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

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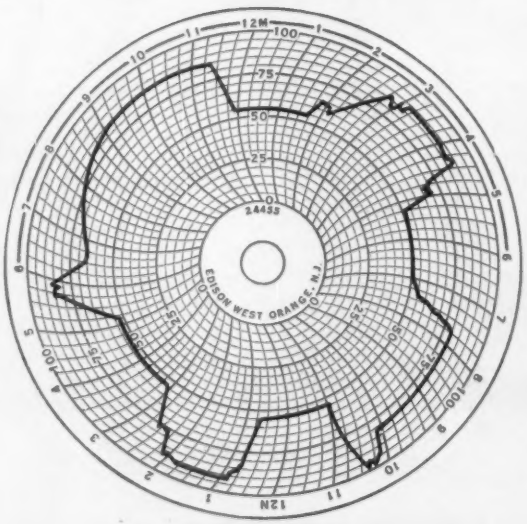
- RECORDS ANY VARIABLE
- REPLACES METERS OR INDICATORS
- PANEL OR BULKHEAD MOUNTED
- BUILT-IN VARIABLE CHART SPEED
- JUST 3¾″ x 3¾″ x 3″



Now you can take advantage of a new, economical means of recording any variable that can be converted to an electrical signal. Thanks to Omnicorder, you need no longer rely on meters or indicators, even where cost factors or space restrictions would ordinarily dictate the use of these instruments.

Measuring just 3¾″ x 3¾″ x 3″, Edison's Omnicorder, a unique circular chart recorder, is so compact that nine units occupy just one square foot of space. Thoroughly legible, yet requiring no ink, pen or ribbon, Omnicorder is equipped with a simple three-speed adjustment which regulates chart rotation, thereby providing time sequences to meet varied needs. A flick of the switch gives users a choice of these sequences: one hour, seven hours and thirty hours per revolution — or one day, seven days and thirty days per revolution.

Omnicorder's simple, inexpensive construction assures dependable operation and a long, maintenance-free life. Four types of meter movements are available to measure a wide range of AC and DC electrical quantities, ranging from thermocouple outputs to currents as high as 100 amperes. No amplification is ever required, even for signals as low as 10 microamps.

For complete information on this rugged, maintenance-free Omnicorder, write for Catalog 3057.

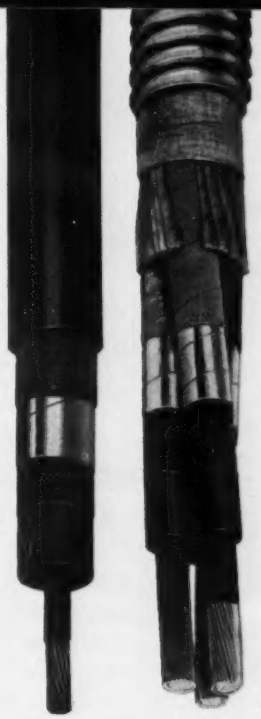
Stylus operates through this slot. The measuring system is sealed off from any careless tampering.

Zero Set Screw: Adjustment is made when measuring system is not printing and when the circuit to be recorded is disconnected.

Thomas A. Edison Industries
INSTRUMENT DIVISION
39 LAKESIDE AVENUE, WEST ORANGE, N. J.

How Circle exceeds the specs to give you...

MAXIMUM LONG TERM STABILITY



Most ordinary products generally manage to *meet* specifications. The quality product is recognized by the way it *exceeds* them.

Take, for example, Circlesheath Type RR Power Cable and the important IPCEA-NEMA 60 cycle water absorption test. Requirements call for immersion in water for 14 days with maximum SIC change and stability factor of 5% and 1% respectively.

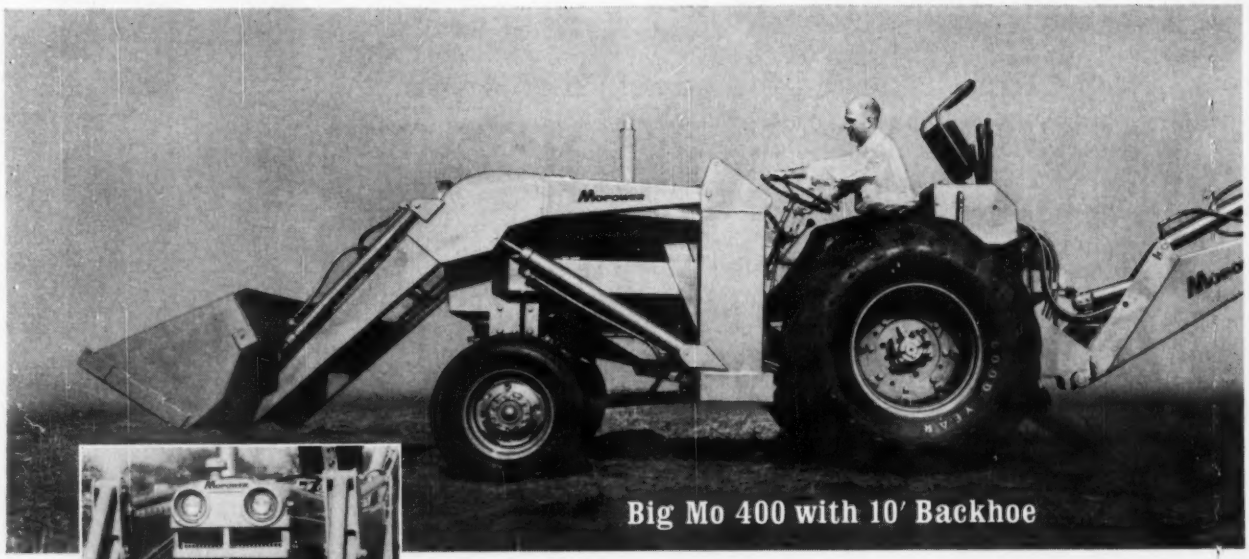
The table below clearly indicates Circlesheath superiority – not only after 14 days submersion but after *two years and ten months in a test that was originated in September 1958!*

Long term stability is only one of the many ways Circlesheath exceeds specs to give users maximum performance. For complete reliability, specify Circle on your next job – there's no finer power cable made.

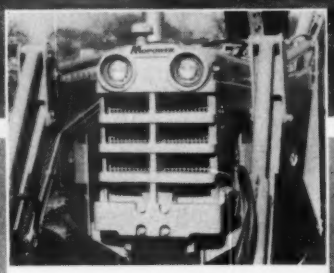
CIRCLE WIRE & CABLE CORP.
SUBSIDIARY OF **CERRO CORPORATION**

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities.
Rubber Covered Wires & Cables • Varnished Cambric Cables • Plastic Insulated Cables • Neoprene Sheathed Cables • "CIRTUBE" EMT

CABLE DESCRIPTION: 15KV, UNGROUNDED, SHIELDED	CIRCLESHEATH® CHANGE SIC	PERFORMANCE STABILITY FACTOR
700,000CM	4.3%	.6%
300,000CM	3.9%	.5%
300,000CM	3.6%	.4%

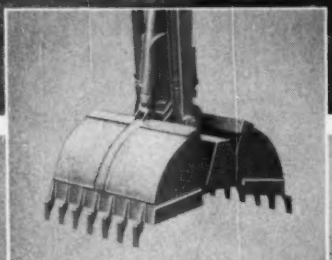


Big Mo 400 with 10′ Backhoe



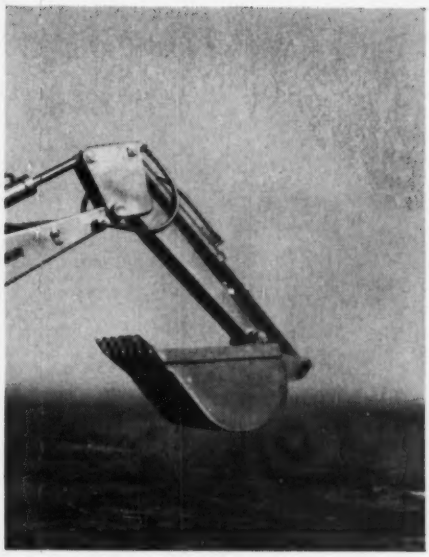
Big Mo 500's new, 400-lbs.-heavier front end . . . exclusive new ⅞ yd. loader!

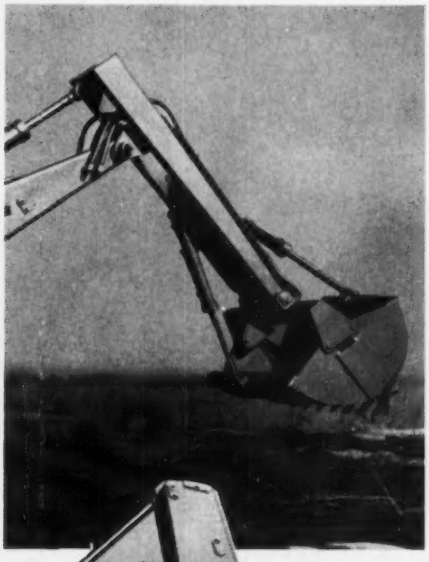
Big Mo 500 with 13′ Backhoe

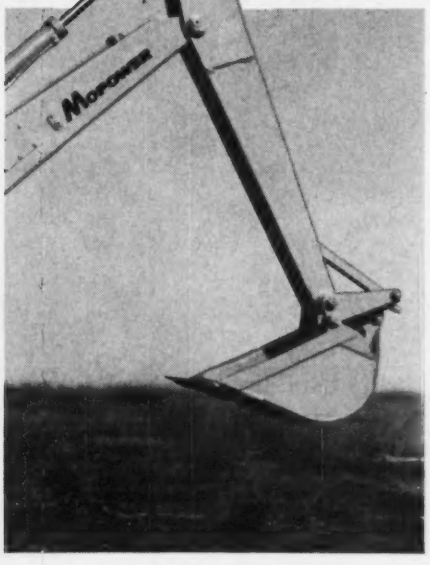


New Mopower Hydro-Clam . . . available on the 13′ and 15′ backhoes!

Big Mo 500 with 15′ Backhoe







PICK YOUR DEPTH... 10, 13, 15 FEET!

Only the new line of Big Mo's give you this choice of backhoes . . . plus exclusive new ⅞ yard loaders, new 400-lbs.-heavier front ends!

Now, new Mopower *flexibility!* The Big Mo 500 available with 13′ or 15′ backhoe! The Big Mo 400 with 10′ or 13′ backhoe!

Mopower lets you pick the muscles to match your jobs! Just take a good look at that Big Mo 500 with its exclusive new *15′* backhoe—the longest, deepest digging backhoe you can get! Then, read on! There's more! Remarkable new "500" features like the exclusive new ⅞ yd. loader with 6000 lbs. of brute breakout force; a new self-leveling mechanism that levels and holds each bite automatically; a new front end with 400 lbs. of added weight for surer balance; and a new hydraulic system for high speed operating of the bigger backhoe and loader.

These new advances, along with the 500's no-clutching shuttle reverse and its powerful Motec-built engine, give it the muscle and mobility needed for your toughest jobs.

The new Big Mo 400 is no lightweight, either. Its new, heavy duty front axle is 226 pounds heavier for better balance in backhoe work. The loader holds ⅝ths of a yd. *struck*. And remember, the 400 is available with a 10′ *or* a 13′ backhoe. In addition, it has the same rugged Motec-built engine as its big brother, the 500. And the low-priced 400 is available *without* the backhoe or loader . . . for mowing, drawbar work, *wherever* you can put this versatile wheeler to work.

Check *all* the features of the new Big Mo 500 and 400 at your Mopower dealer's *today*. Then, *pick the muscles to match your jobs!*

Mopower's mighty Motrac Crawler . . . with new 40° bucket rollback for "healthier" bites, new 50° dumping angle—the maximum available, and new, shorter lift time and dump time (6½ seconds). Test drive it at your Mopower dealer's *today*.

MOPOWER

Construction Equipment • Division of MOTEC INDUSTRIES

LAPP CONTROLLED-POSITION CONSTRUCTION

A new type of insulator from Lapp offers cost reduction, economy of space and convenience of construction to solve many problems of transmission line design

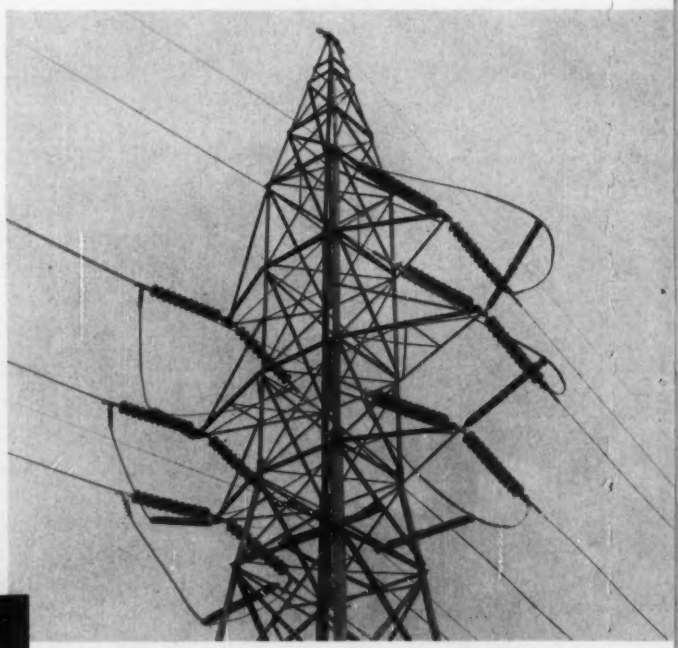
Lapp strut insulator, 117" long, matches electrical and mechanical ratings of an 18-unit string of 5¾" x 10" standard suspension insulators.

Lapp Controlled-Position Construction is a new technique in transmission line design which utilizes porcelain rods or struts—with fog-type leakage corrugations—to hold in fixed position and/or restrain high voltage conductors.

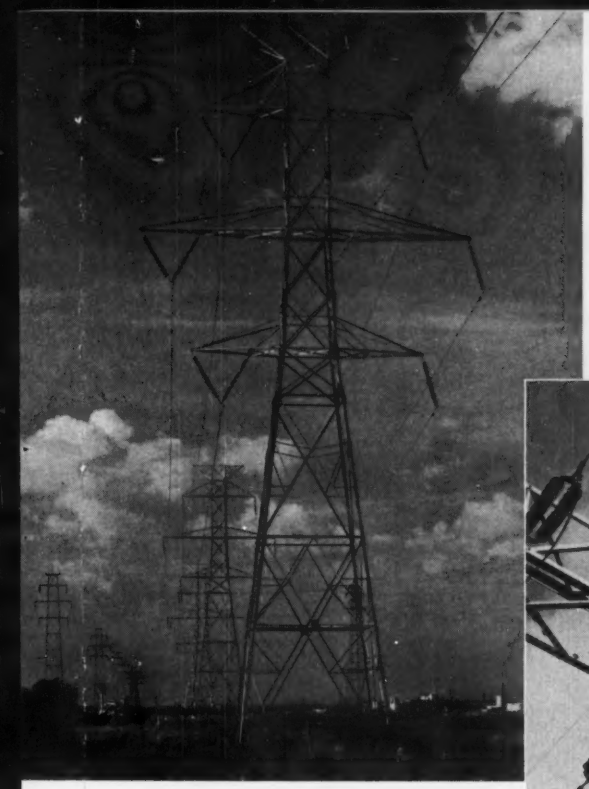
Use of Lapp Controlled-Position Construction on tangent structures invariably results in more compact design with consequent lower structure cost and narrower right-of-way requirements. Its use in jumper restraint provides neat efficient appearance and eliminates radio and TV interference such as is generated by lightly-loaded suspension strings.

WRITE FOR BULLETIN. Lapp Brochure No. 478 describes the development and application of Lapp Controlled-Position Construction . . . suggests design procedures . . . lists specifications and characteristics of Lapp strut insulators. Write for your copy.
Lapp Insulator Co., Inc., Le Roy, N. Y.

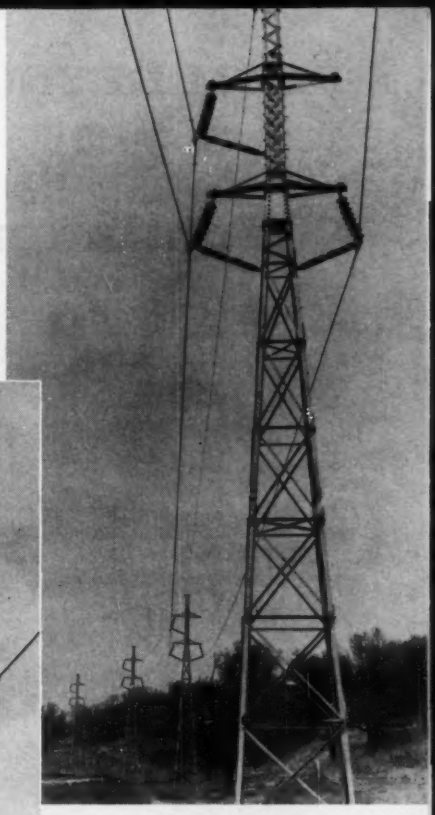
Lapp

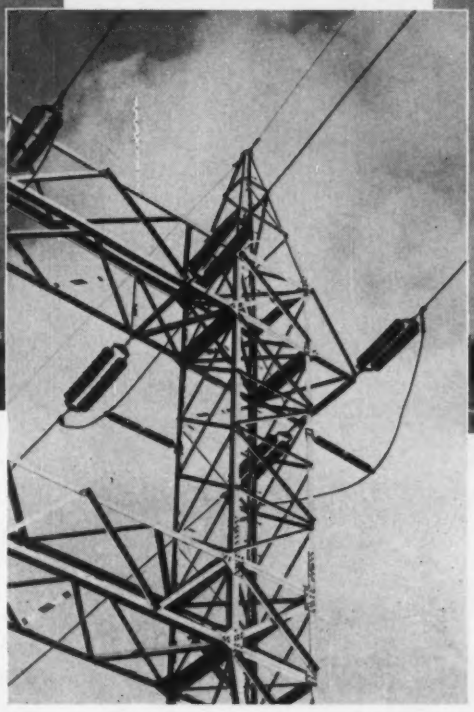


138 kv LINE AT HALF-PRICE! Conversion of 69 kv line to 138 kv accomplished with Lapp Controlled-Position Construction. Existing tower required only some reinforcement. Short crossarms are adequate, however, with use of Lapp strut insulators, to control dead-end jumpers, prevent their swinging, and maintain clearance from tower and between phases. Total construction cost: less than half that estimated for a new 138 kv line.



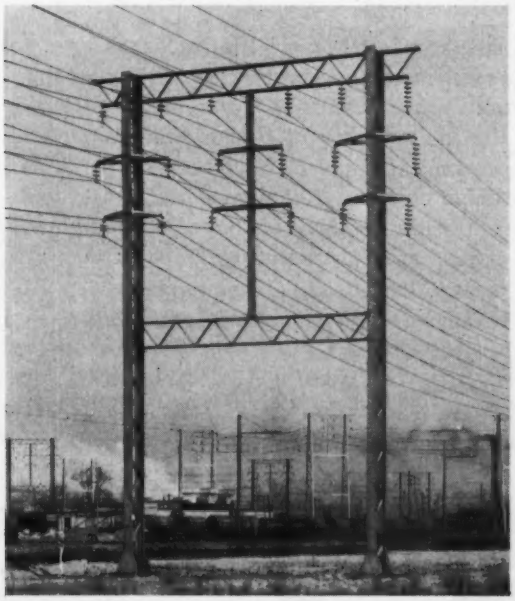
LONG JUMPERS STAY PUT! Lapp Controlled-Position Construction restrains long jumpers. This 115 kv dead-end structure keeps the line within its limited right-of-way—Lapp struts hold the 26 ft. jumpers safely away from the tower. No radio or TV interference either, as occurs with suspension strings used for jumpers.



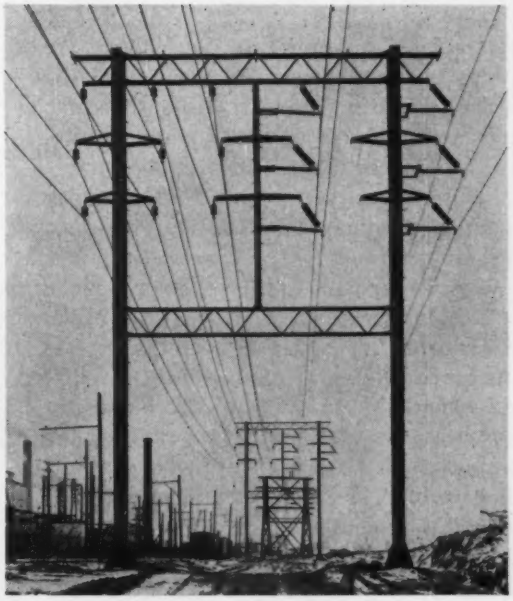


CUTS SHORT ON THE TURNS! Lapp Controlled-Position Construction is well suited for angle construction at high voltage. As on this 220 kv line, Lapp struts supported from crossarms and attached to lower end of suspension string are used to maintain clearance, holding conductor out and away from the tower. No need for longer crossarms, arm-end brackets or other construction that add cost or right-of-way requirements.

RADIO-TV INTERFERENCE ELIMINATED! As originally built in 1924, this 115 kv line used wood lower crossarms and tie-down insulators to stabilize conductor at angle structures. Recently reconductored, using Lapp Positioned-Construction. Lapp strut insulators position conductor and assure tower clearance. Radio and TV interference generated by tie-down insulators is now wholly corrected.



BEFORE 35-year old steel tower line carrying three 69 kv and three 12 kv circuits. Increased load required replacement of the three 69 kv circuits with two 115 kv circuits. The three 12 kv circuits were to be retained, and old portal-type steel structures were to be used; additional right-of-way not available.



AFTER Same line after conversion. Two reinsulated 115 kv circuits are suspended from original crossarms. Lapp strut insulators attached to extension brackets on the towers push conductor-insulator assembly up and out, provide adequate clearance between circuits, tower and ground. 12 kv circuits remain.

FROM REYNOLDS

...a new cost-saving aluminum extrusion application

Aluminum sheet is bolted to the top of the extrusion (inset) forming separate rows of open end ducts.

for transformer heat exchangers

The special aluminum extrusions above are used as heat exchangers in a gas insulated rectifier transformer made by General Electric. Their primary purpose—efficient cooling. Their biggest advantage—cost savings.

Because they are extruded, these complex structures cut fabrication time. The extrusions are simply cut to length and welded together forming two separate rows of open-end ducts. Hot insulating gas is blown through the inside surfaces while air is passed over the outside ducts to remove heat. And, because aluminum has a remarkable capacity to absorb and dissipate heat, these extrusions perform their job with maximum efficiency.

The use of an aluminum extrusion also helps minimize the chance of leaks, and the extruded vertical fins provide sufficient strength to withstand total vacuum without additional bracing.

These particular Reynolds Aluminum extrusions are of a very special design for mining-type rectifier transformers. Because of the versatility and savings possible with aluminum extrusions, the individuality of design was simply and economically solved. If you have a particular design problem, call on your nearby Reynolds representative and see if one of the many ways of fabricating aluminum can help you. Or, write to *Reynolds Metals Company, Box 2346-EL, Richmond 18, Virginia* for information.

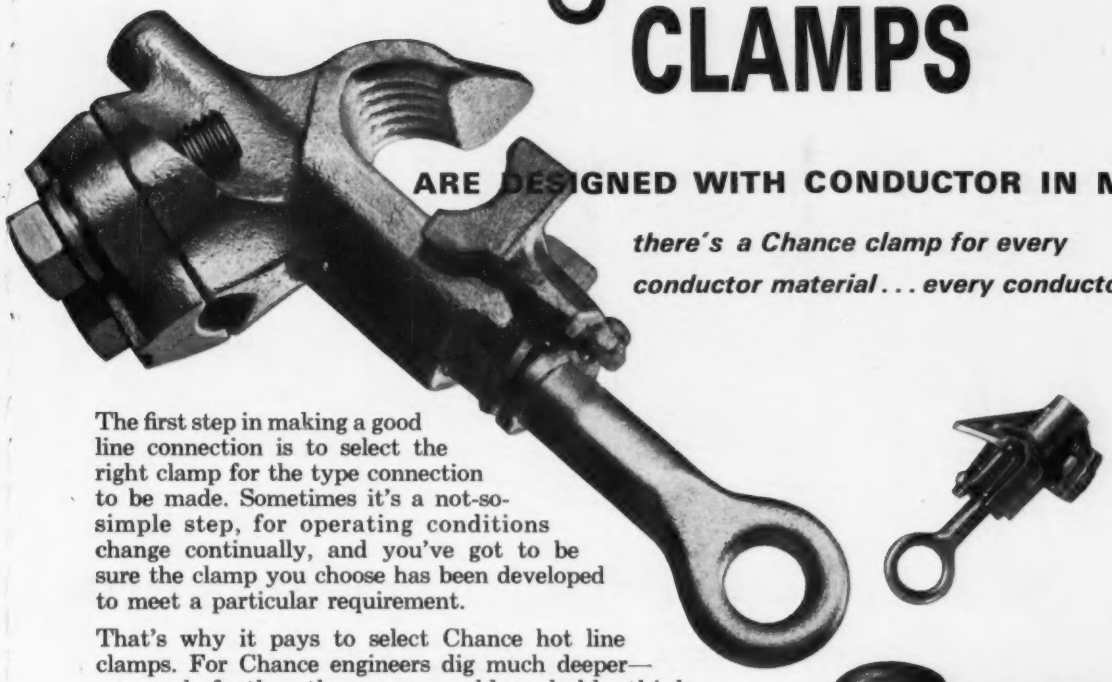
Watch Reynolds TV show
"Harrigan & Son", Fridays—ABC-TV

REYNOLDS ALUMINUM

CHANCE CLAMPS

ARE DESIGNED WITH CONDUCTOR IN MIND

there's a Chance clamp for every conductor material . . . every conductor size



The first step in making a good line connection is to select the right clamp for the type connection to be made. Sometimes it's a not-so-simple step, for operating conditions change continually, and you've got to be sure the clamp you choose has been developed to meet a particular requirement.

That's why it pays to select Chance hot line clamps. For Chance engineers dig much deeper—go much further than you would probably think necessary—to develop hot line clamps.

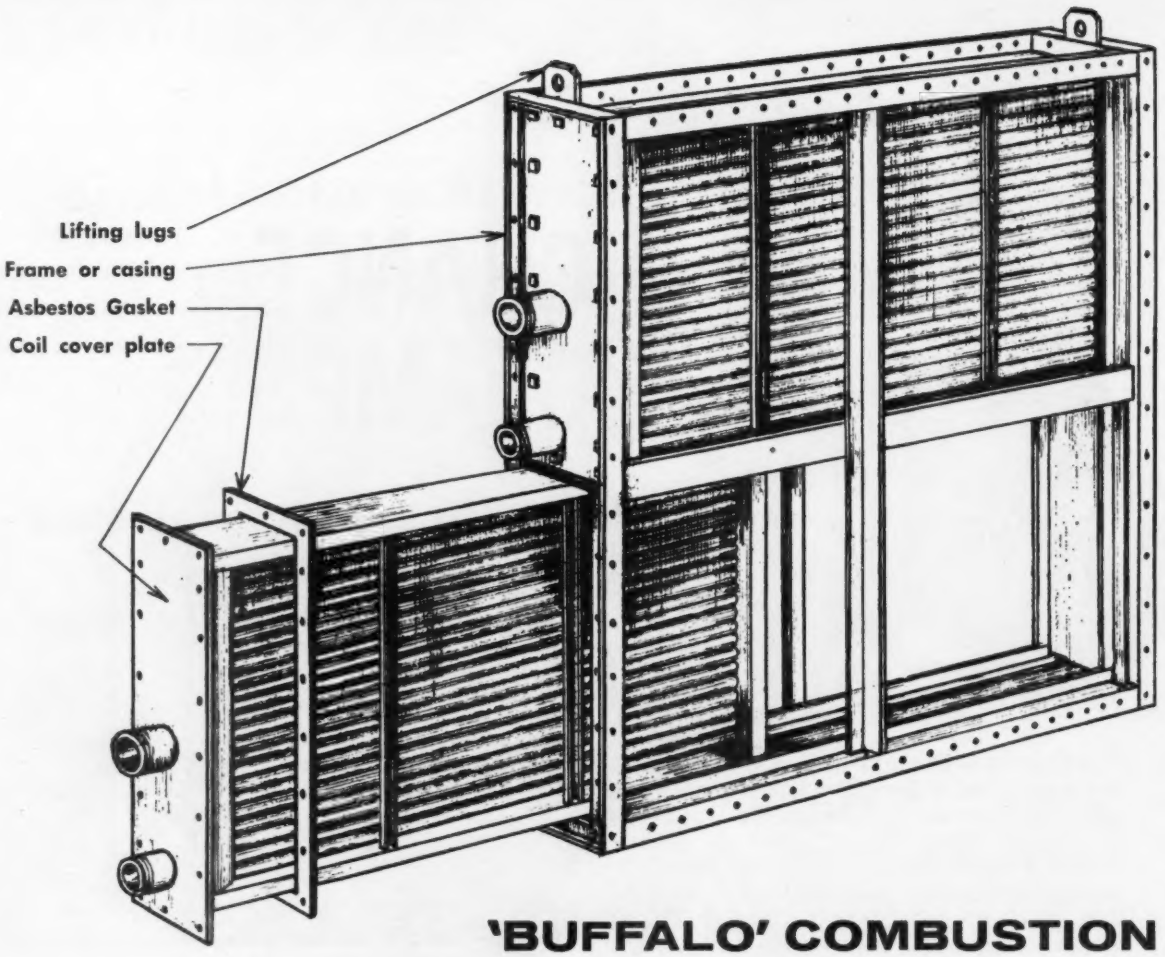
Chance clamp engineers have been "digging deeper" for 28 years now. They've picked up a lot of skills and experience in that time. They are clamp experts . . . *creative designers* who have contributed such clamp innovations as T-type terminals, aluminum body clamps, compensation for line vibration, and control deflection of the eyescrew.

This creativity in design is one good reason why Chance is the world's largest producer of hot line clamps. It's the very best reason why you'll find the clamp you need for copper to copper, aluminum to aluminum, and general purpose connections in the complete Chance tap clamp line. And they're available individually packaged in plastic bags with Chance z.l.n. 100 Contact Aid already applied.

Ask your Chance Man about the operating benefits that are engineered into each Chance clamp. He has the full story, and he'll help you select the right clamps for your applications.

A.B. CHANCE CO.
CENTRALIA, MISSOURI
A. B. Chance Company of Canada, Ltd. Toronto

CC61-13



'BUFFALO' COMBUSTION AIR HEATER PACKAGES

cost less to install and maintain!

Expensive on-the-job fabrication of coil casing and frame is eliminated when you use factory assembled 'Buffalo' combustion air heater packages. Aerofin heavy-duty steam or hot water heating coils of tapered fin design give maximum heat transfer and low air-side static loss. Heater casing of heavy structural steel prevents binding when coils are removed and inserted. The removable core cover plate, with gasket, is bolted to the casing or frame to provide a gas-tight fit at high static pressures. For low cost, easy maintenance combustion air heaters, contact your resident Buffalo Representative or write for Bulletin FD 800.

AIR HANDLING DIVISION
BUFFALO FORGE COMPANY
Buffalo, New York
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

WE GATHER WOOD

from the Pacific Northwest to Malaya to the Philippines

Apitong Crossarm Braces
J5526 and J4700 Series

Fir Crossarm Braces
J5100 and J4400 Series

The woods used in Joslyn Crossarm Braces, Douglas Fir and Apitong, have inherent physical qualities which make them ideal for this use.

To fortify these built-in characteristics, we add the magical touch of chemistry, prolonging the life-span of the wood by controlled pressure treatment with pentachlorophenol to a six-pound retention.

Wood braces increase the impulse insulation level of a structure. These Joslyn wood braces are designed with static-proof fittings — having strength where it is most needed — produced and serviced with all the facilities of the Joslyn organization.

Contact your Joslyn representative for more details on Joslyn Fir and Apitong Crossarm Braces.

JOSLYN MFG. & SUPPLY CO., 155 N. WACKER DRIVE, CHICAGO 6, ILLINOIS

A look inside an E-M Straight-Up-Ventilated

A Smooth Running Motor

HAND-CRAFTED CONSTRUCTION
by skilled craftsmen is the only way to achieve the smooth motor operation shown in pictures at right, top. Coils are carefully lashed one to the other and to heavy support rings. Bearing brackets are hand tooled for perfect bearing fit.

E-M

1300-TPA-2293

ELECTRIC MACHINERY

Builders of the new pump motor

Boiler Feed Pump Motor will show you

Doesn't Just Happen...

LISTEN CLOSELY. This running E-M Motor is not dead silent—just remarkably quiet. And when you stand near an E-M Straight-Up-Ventilated Motor, you aren't blasted in the face with hot air. Cooling air goes straight up.

NICKEL-ON-EDGE demonstrates fine balance of operating E-M boiler feed pump motor. Engineers visiting E-M factory learn Straight-Up-Ventilated Motor balance is far superior to usual commercial standards.

Quiet operation, precise balance result from E-M's imaginative engineering, thorough workmanship

The eye-opening boiler feed pump motor performance pictured above isn't confined to the test floor. It lasts for years. And E-M planned it this way because power plant engineers asked for it.

Yes, here is a motor that embodies those design features most wanted by power plant engineers:

1. Locked-in rotational stability that assures a lifetime of smooth operation.

2. Built-in acoustical control that makes the motor as quiet as the pump.

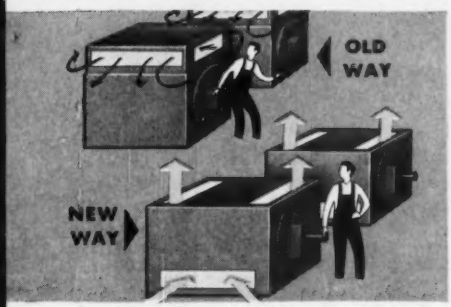
3. Top air discharge that carries ventilating air up and away—no recirculation or cross circulation to affect cooling of motors.

4. Easy access that enables one man to disassemble the motor for routine inspection without a hoist.

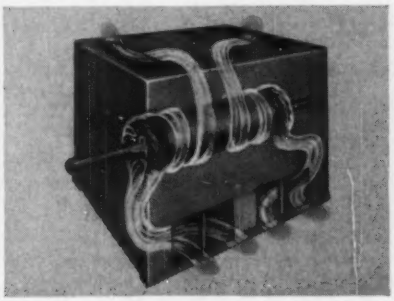
5. A low silhouette that lets you look over the motor to see other personnel and equipment in the pump room.

Your nearby E-M Field Engineer will be glad to give you complete details of E-M's finer motor construction. Call him, and write the factory for your free copy of the Straight-Up-Ventilated Motor Brochure No. 1134W.

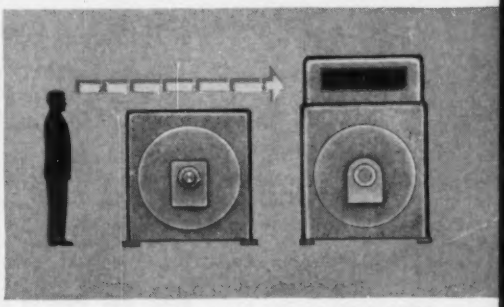
MANY BIG DIFFERENCES MAKE THE DIFFERENCE



STRAIGHT-UP-VENTILATION



AIR-FLOW ACOUSTICAL CONTROL



MINIMUM HEIGHT—MAXIMUM VISIBILITY

MFG. COMPANY MINNEAPOLIS 13, MINNESOTA

that performs as well on the job as on the test stand

1134P

the long life coating that's ideal for industrial areas

BETHALUME STRAND

Bethalume Strand, a new hot-dipped strand made by Bethlehem, has the lasting strength of steel, combined with an aluminum coating for protection against corrosion. The Bethalume coating is uniform and tightly bonded to the steel, providing the strand with excellent weathering characteristics under most atmospheric conditions.

We've just printed a two-color folder describing Bethalume Strand. If you would like to have a copy, call the nearest Bethlehem sales office. Ask for Folder 777.

Steel

for Strength
. . . Economy
. . . Versatility

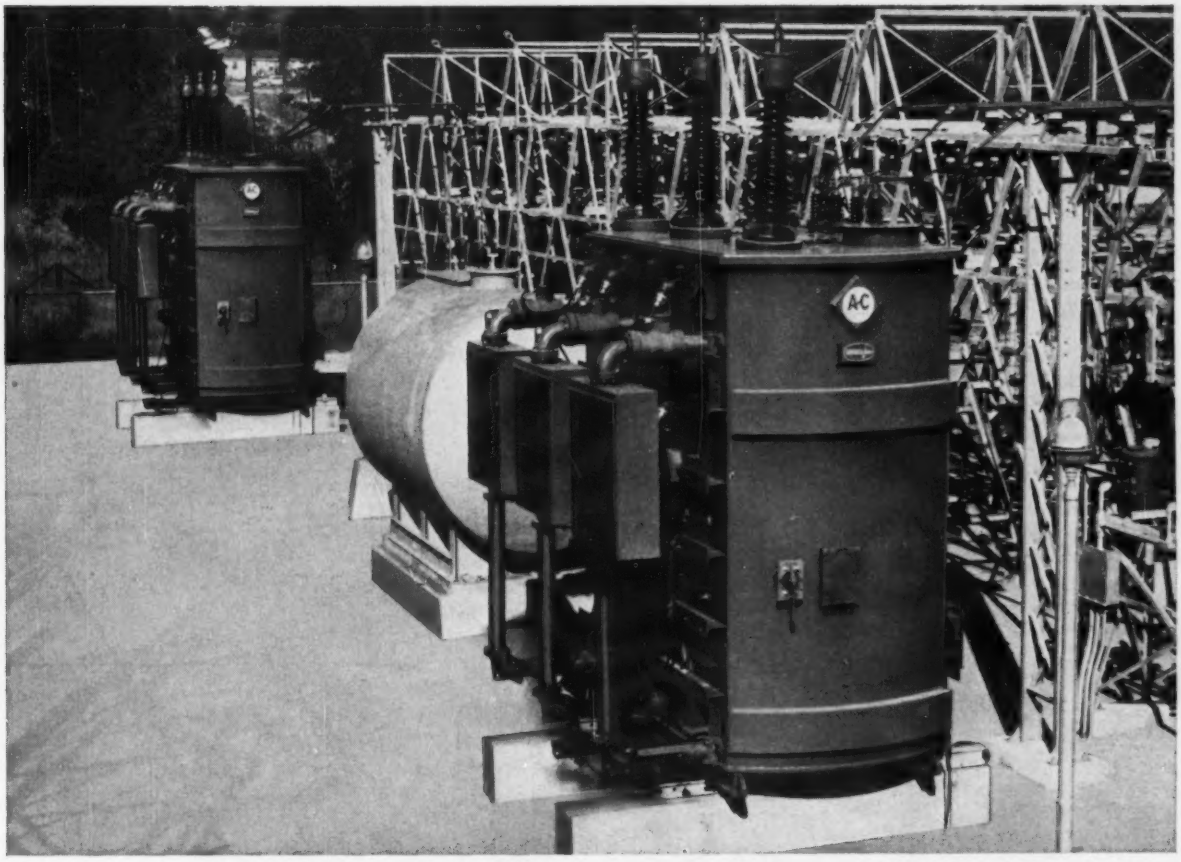
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

ALLIS-CHALMERS

A-1461



Gulf Power Company's Bayou Chico Substation, Pensacola, Florida, uses 20,000-kva DUAL-COOLED transformers.

33% greater capacity

Dual-Cooling uprates either of two 20,000-kva transformers to 26,667 kva

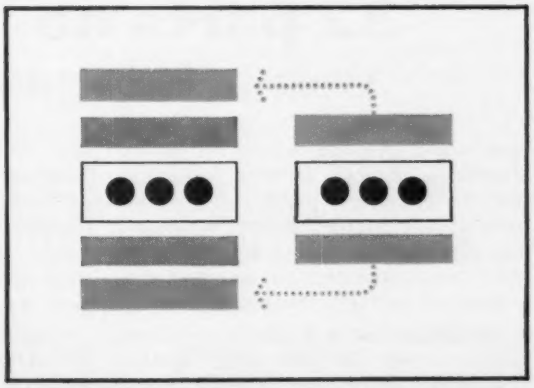
Now *Dual-Cooled* transformers offer both central stations and substations new opportunity to purchase *more* transformer capacity for *less money!*

With A-C dual-cooling, either of two 20,000-kva transformers, for example, can continuously carry 26,667 kva without loss of life.

Here's how it's done. In the event one transformer is off the line during an emergency, coolers from both units are connected to the functioning transformer. Emergency capacity of either *Dual-Cooled* transformer is increased one-third over its normal rating.

Dual-Cooled transformers are offered in any rating from 20,000 kva up. Contact your nearby A-C office for *Dual-Cooled* transformer application facts or write **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wisconsin.

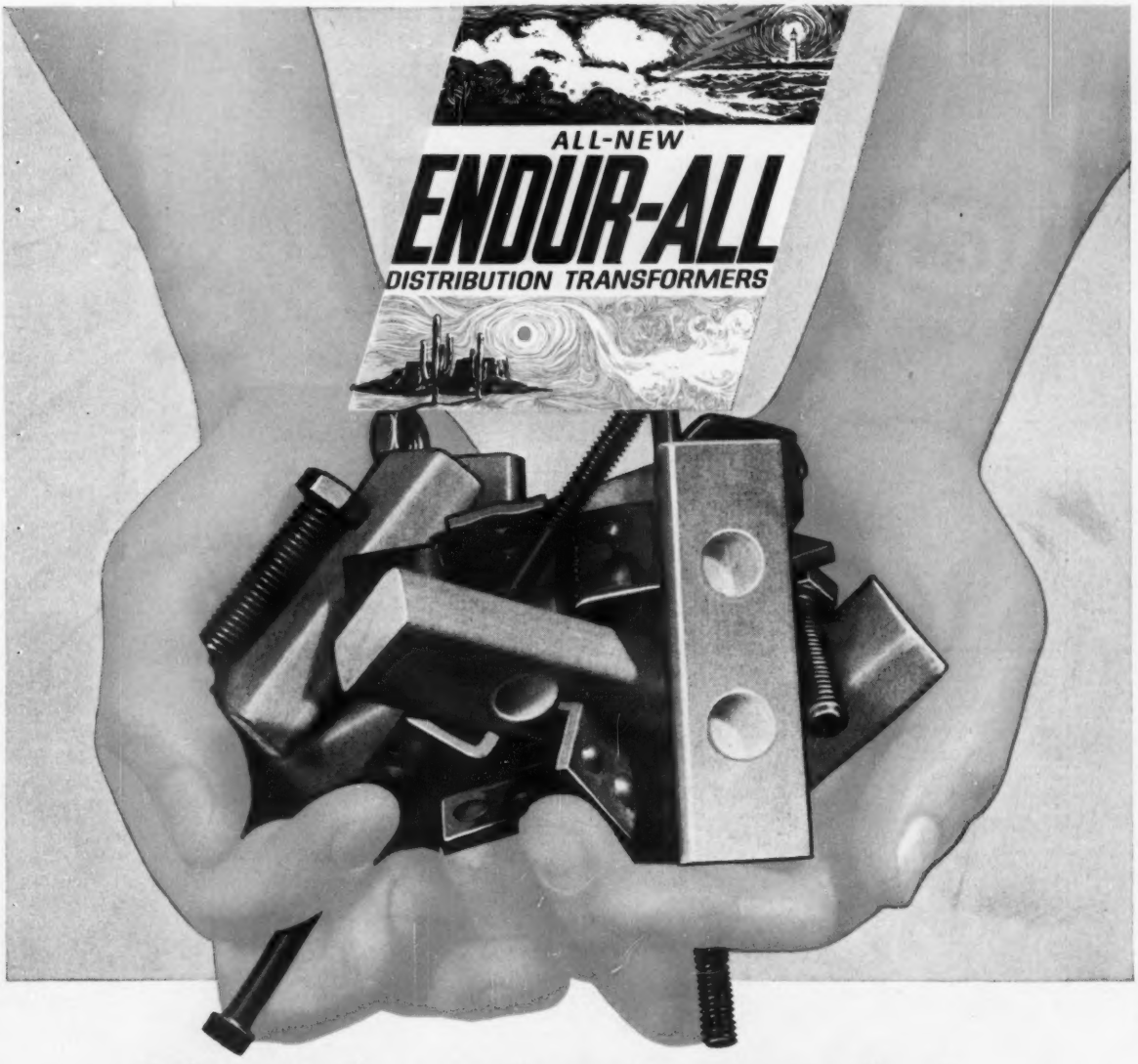
Dual-Cooled is an Allis-Chalmers trademark.



In dual-cooling, a transfer of coolers from one transformer to the other uprates the active transformer capacity 33%.

ALLIS-CHALMERS

A-1463



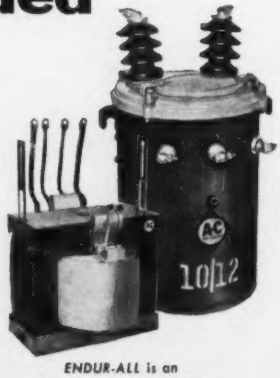
32 parts no longer needed

. . . 32 potential trouble-makers eliminated!

New locked core-and-coil end-frame construction eliminates 32 nuts, bolts and washers! Nothing to loosen . . . no welds to break. Unique A-C locking straps assure uniform high compression for *greater short-circuit strength*. And more duct area is exposed for *more* efficient cooling.

These additional A-C enduring values give you more for your ENDUR-ALL transformer dollar: New overload capabilities with new high-temperature oil and new high-temperature insulation • impedance is reduced as much as 25% — allows full utilization of the greater overload capacity • units are 10% lower, 10% lighter for easier hanging • new high-gloss-retention paint features 3 baked-on coats • new nonaging, reusable gasketing.

Call your nearby A-C office for more ENDUR-ALL *transformer facts or write* **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.*



ENDUR-ALL is an Allis-Chalmers trademark.

Editorial Comment

MAY 8, 1961

Identical Prices Do Not Equal Collusion

The US Attorney General, in an interview, has pointed out that the Justice Department is concerned with conspiracy and collusion, not with prices. "I can conceive of a number of different instances," he said, "where you have identical pricing which wouldn't be illegal or improper."

His comments followed by a day the issuance of a Presidential order requiring government agencies to report all identical bids over $10,000 to the Justice Department.

We believe his brief remarks can do much to put the question of identical bids in perspective.

It is true that identical bid complaints by government agencies provided much of the stimulus for the electrical equipment antitrust investigations and court actions. It is not true that the government ever based its cases on identical bidding, or that it attempted to show that identical bids *per se* were illegal or unethical.

Subsequently, there have been a number of instances of identical bids to government agencies. These have received a good deal of publicity; politicians have used them to infer that it is possible that illegal pricing practices are continuing.

Anyone who has any understanding of legal and ethical pricing practices in those products which are virtually commodities has a keen feel for the mechanisms by which such prices can end up identical. It would happily appear the Attorney General has such a feel.

It is high time that someone of influence in the government has spoken, even indirectly, against the insidious practice of equating identical pricing to collusion. We are glad the Attorney General has done it.

Utilities Excluded in Tax Proposals

The President's recent tax message to Congress shredded any illusion that his policy of cooperation with business extends to utilities. It proposed certain federal corporate income tax benefits, but specifically excluded utilities (except transportation).

The proposals were designed to stimulate business capital outlays with tax credits for capital investment above certain levels of depreciation allowances. To the extent that general business loosens its purse-strings under such encouragement, investor and non-investor utilities would of course benefit from the resultant increased load growth.

But the utilities themselves—electric, gas and telephone—will not be able to benefit directly if the proposals are enacted. The reasoning is not hard to find. First, the government could lose in the neighborhood of a third of a billion dollars of annual tax revenue from electric companies alone, due to their high capital expansion rate; added to the loss from other utilities, this would call for an entirely different tax program from that proposed. Second, the government undoubtedly feels utilities generally need no incentive to continue expansion.

Ironically, the same tax proposals also move to tighten loopholes through which cooperatives generally escape paying federal taxes, but here again electrical cooperatives are specifically excluded.

It is evident that the investor-owned utilities can expect little relief from existing discrimination, and indeed, must brace themselves for more.

Public Power Closes Ranks Behind

Interconnected power pools are topic of the day as APPA members are told to 'think big' with present opportunity

Promises that the nation has entered an era of "proper leadership at the federal level" which will see greater, more complete, public power systems were warmly received by some 600 representatives at the American Public Power Assn's annual convention in San Antonio last week.

They were admonished, however, to "think big" in order to make the promises come true.

Various speakers painted a glowing picture for public power, one that will see more large-scale, interconnected power pools; federal transmission lines on a regional, inter-regional, and even national basis; and federal development of water resources and atomic power plants.

To get these things, the gist of the speeches went, more reliance will have to be placed on federal leadership and resources. Local consumer group representatives were told, in effect, to give up fears they may have of pooled interconnections bringing about federal control over their systems. Such pools, said out-going President D. J. DeBoer, "may be the only means for continuation of local independent operation."

Holum Speaks for Interior

Assistant Interior Secretary Kenneth Holum told the group that he found the federal power program "idling in neutral" when he entered office. Program planning and engineering plans for new hydro projects were virtually empty, he claimed, but he quickly added that this "policy has been reversed."

He pointed to such things as the Bureau of Reclamation's Denver office going on a 58-hour week to "press ahead" hydro projects and transmission system for the Upper Colorado development. He referred to President Kennedy's recommendation to Congress that the Hanford atomic reactor be converted to a dual-purpose plant as being in sharp contrast to "the apathy" of the "previous administration."

Holum promised federal agencies will play "a positive role" in developing nationwide common carrier transmission systems, including the construction of large capacity tie lines between principal federal power developments. He said if Congressional approval of the proposed Pacific Northwest-Pacific Southwest line is obtained, "it will become the first major step in this program."

He urged local public systems and rural cooperatives to extend greater effort toward interconnecting their systems.

Alex Radin, APPA general manager, told the representatives they must "take advantage of the economies of large-scale generation and transmission of power, and interconnection of power systems both on a regional and inter-regional basis." He predicted publicly-owned utilities will double their business volume in ten years, and said pooling and interconnections represent the only way to supply these requirements.

Radin also said APPA must "press for federal transmission lines to see that federal power is not made the captive of the private power companies," and urged more reliance be put on the federal government for developing atomic power.

There was no doubt but what he agreed with Rep Chet Holifield (D-Calif.), who said atomic development under the "partnership" approach has failed. Holifield claimed the failure has been due to lack of "dynamic" federal leadership.

"It seems . . . time (for) the Atomic Energy Commission (to) move ahead with the development, construction, and operation of a sequence of developmental projects," Holifield said. He said the recommendation to convert the Hanford reactor is "extremely encouraging.

"Once we get the NPR generating facilities authorized, and ascertain which of AEC's currently authorized projects should go forward, I believe that AEC and the Joint Committee should have a little get-together to see where we go from here," he added. "The private power people, the co-ops and yourselves, as well as the industrial equipment companies, have a stake in the development of a more aggressive program."

Holifield said he would not preclude the construction of additional plants by investor-owned utilities, but said the "US program should not be primarily dependent on such projects."

Plan for Atomic Power

Holifield also said that during the developmental period, "I suggest that you prepare for the future use of atomic power by planning now for interconnection of your public and co-op systems."

He told the group it should "remain interested" in developing small atomic plants, but added there "is no assurance that economic reactors of less than, perhaps, 50,000 kw can be developed in the foreseeable future." APPA later passed a resolution, however, urging that additional small plant projects ranging up to 50 Mw "be initiated promptly by the Atomic Energy Commission."

Continuing the theme of joint cooperation for "the new era," several speakers outlined the status of various projects around the country.

Harvey McPhail, executive director of Colorado Basin Consumer Power, Inc, said his group intends to continue all-out efforts to secure an all-federal transmission system from the Colorado River Storage Project. He said his group now includes "almost 100%" of the consumer groups in Colorado, New Mexico, Arizona, Utah and Wyoming.

McPhail said his group's latest study shows power costs to preference customers would be almost $5 million a year greater if an all-federal system isn't constructed. Five major investor-owned utilities in the area proposed in 1959 that they build a major portion of the transmission system.

As he sees it, "Perhaps the great-

'Federal Leadership'

est all-out effort in history on the part of the private power companies to stifle federal power operations is in the offing."

The investor-owned companies, McPhail said, have said their building of a part of the system will save the government about $120 million. McPhail said, "No mention is made of the fact that over $600 million must be appropriated by the Congress over the repayment period to cover wheeling payments to utilities in exchange for this so-called saving to the federal treasury."

He also said his group's studies show local and federal tax losses to an all-federal system will be $1,750,000, whereas the investor-owned firms have said as much as $4 million per year are involved.

Owen W. Hurd, managing director of Washington Public Power Supply System, pointed to the Nez Perce project as an "outstanding example of regional cooperation on the part of local public agencies and cooperatives." Hurd said the basic factors which have brought about controversy in the Nez Perce project are "low-cost power and comprehensive maximum development in the public interest versus high-cost power and piecemeal development of the total water resources of the Middle Snake and Salmon Rivers."

He said if four investor-owned utilities are successful in getting a license to build the High Mountain Sheep Project on the Snake River above the Salmon River, there will be a "repetition of the Hells Canyon tragedy in terms of higher power costs, loss of flood control benefits, piecemeal and underdevelopment of the region's resources, a brake on industrial expansion, and a threat to the integrity of the Northwest regional federal transmission grid system."

On the other hand, Hurd said, a license for Nez Perce to the public agency applicant would insure maximum development in the public interest, low-cost power, maximum utilization of the federal grid system, and assure supply of power to the participating utilities.

Hurd added that, in the squabble over fish passage facilities, the Nez Perce project will result in less loss of migratory fish than any other of the ten present and future dams below Nez Perce.

William E. Trommershausen, consulting engineer of Midwest Electric Consumers Assn, said there may be too much power planning and too little coordination in the Missouri Basin. He said a committee has recently been organized to develop some basic power marketing policies which will "foster an orderly development of a hydro-thermal power supply program for the Missouri Basin."

Represented on this committee are all preference customers and federal agencies. He said progress is expected during the calendar year 1961 by this committee toward developing broad power marketing policies that will "foster the development of a balanced program of installation of additional thermal generation by both the preference customers and private utilities."

Hydro-Thermal Plan Wanted

Trommershausen also said it is hoped "at the earliest practicable date" an optimized hydro-thermal plan" will be developed up to 1980. Without such a general guide, he said, it is possible some "uneconomic transmission facilities may be constructed by some of the groups now actively planning on thermal generation."

He also said that a review of recent Missouri Basin transmission studies indicates they were not founded "on the broad concept of an optimized hydro-thermal system." It is expected, he added, that "more comprehensive studies" will show better utilization can be made of existing and potential hydro power. Referring to various tie line studies underway, he said it is important that priority be given all of them.

H. A. Tynan, manager of electric system, City Public Service Board, San Antonio, said investor utility plans are made to link major load areas of Texas. This is to include Houston, Dallas-Ft. Worth, and the Odessa-Midland area in west Texas with about 800 miles of 345-kv transmission lines.

(*Continued on next page*)

HOLIFIELD

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APPA Manager Radin said it is time "we made a concerted, frontal attack" on the problem of "legal and other roadblocks" to "joint action by local public agencies."

In this connection, he said, APPA has hired an electrical engineer to aid members in working out joint power supply arrangements. He is Herbert Blinder of the Sacramento Municipal Utility District. He will join APPA July 1.

Resolutions passed by APPA included:

- A stand against legislation imposing a federal tax on income from state, municipal and other public agency bonds.
- Endorsement of federal or other public construction of the Pacific Northwest-Southwest intertie system.
- Request that Colorado River storage project grid system be an all-federal system.
- Support for creation of a nationwide common carrier grid. This resolution also requested that the federal government initiate steps for the implementation of this concept, including the interconnection of present federal generating systems.
- Request that FPC dismiss Pacific Northwest Power Co's application to build the Mountain Sheep project.
- Another dig at "large tax subsidies" of investor-owned power companies, urged Congress to amend laws to "prevent investor-owned power companies from obtaining the tax benefits available."
- Request that Congress authorize conversion of the Hanford New Production Reactor, and recommended that the dual-purpose plant be utilized fully as an atomic power training and information center.
- Request for appropriation of funds for studying of the lower Loop River project.

Correction . . .

An article on aircraft-type turbojet-driven gas-turbine generators (EW, May 1, p 46) incorrectly implied that Philadelphia Electric Co has purchased two such 20-Mw units from Bristol Siddeley Engines, Ltd. Actually, the utility has purchased only simple-cycle, single-shaft, conventional gas-turbine units, one from GE and one Westinghouse.

IJC Rules Against Feasibility Of Passamaquoddy Project

The International Joint Commission seems finally to have laid to rest the long-time question as to whether it is economically feasible to harness the huge tides of Passamaquoddy Bay. Under present conditions, says the Commission, it is not.

The Joint Commission report now is being studied by the US and Canadian governments. It is considered most likely that the recommendations will be accepted in Washington and Ottawa and the project will be buried.

Sen Margaret Chase Smith (R-Me.), for 13 years an ardent promoter of the Passamaquoddy dream, anticipates this eventuality. Her next move then would be a direct appeal to President Kennedy who, in the past, has expressed support for the project.

Mrs. Smith does not argue with the specifics of the IJC report but finds it "disturbing" in view of the fact that a previous survey by the Army Corps of Engineers came up with more favorable findings. Other Passamaquoddy supporters feel that a lack of interest on the part of Canada is the chief reason for the adverse IJC report.

View as Long-Range Possibility

The Joint Commission, in finding that the Passamaquoddy Tidal Power Project is not economically feasible at present, recommends that "development of the project be viewed as a long-range possibility having better prospects of realization when other less costly energy resources available to the area are exhausted."

For the purpose of its study, IJC, through its engineering board, checked costs of various possibilities including development of the tidal project alone and the tidal project in conjunction with a number of other auxiliary sources of power. On the basis of these analyses, "the Commission finds that the tidal project alone is not economically feasible and could not provide firm power at a unit cost as low as the cost of power from new alternative steam-electric plants that could be built in the area to meet its future power requirements.

"None of the proposed combination projects considered by the Commission to be valid would provide an economic development for either the US or Canada if they are evaluated on the basis of the usual practices followed in the two countries in determining the economic feasibility of proposed hydro-electric projects." Total cost of the plan deemed most valid by the Commission would be $600 million. The lowest possible unit cost per kwhr to be obtained, says the Commission, is 12 mills for the US share and 16 mills for the Canadian share. At-site unit costs of producing electric energy from the tidal project alone are estimated at 26.2 mills for the US and 42.8 mills for Canada on a 60% annual load factor. Based on a 100% load factor, these would be 18.2 mills for the US and 27.5 mills for Canada.

By contrast, at-site unit costs from steam electric plants in Maine and New Brunswick, the two areas affected, are estimated at 10.6 mills for the US and 7.3 mills for Canada.

"In short, the Commission finds that the tidal project, either alone or in combination with auxiliary power sources, will not permit power to be produced at a price which is competitive with the price of power from alternative available sources." Construction of the project, says IJC, "would have a substantial although short-term beneficial effect on the economies of Maine and New Brunswick during the six-year construction period resulting from expenditures of over $200 million for goods and services." But, it adds, "because of the relatively high cost of development of the tidal power potential, the Commission finds that construction of the tidal project would not appreciably affect industrial development in the project area."

IJC also said the project would provide additional recreation benefits in the area but would have little if any affect on the important sardine industry and other fisheries.

Kefauver Sees Conflict in Stories

The Senate Antitrust and Monopoly Subcommittee last week continued the initial phase in its hearings into price-fixing conspiracies in the electrical equipment industry. It turned from General Electric Co witnesses to Westinghouse Electric Corp executives. The subcommittee scheduled seven Westinghouse witnesses for testimony Thursday and Friday after hearing Robert Paxton, former GE president, and William S. Ginn, former GE vice president, earlier in the week.

Advised to Obey Policy

Ginn testified that GE Chairman Ralph J. Cordiner had twice advised him to obey company policy regarding antitrust laws. Ginn also said he believed Paxton never had any knowledge of meetings with competitors.

But the picture painted by others generally added up to one of confusion, misunderstanding, conflict, and questionable managerial control as related to meetings among competitors in the electrical industry.

The subcommittee, headed by Sen Estes Kefauver (D-Tenn.), is attempting to find out if top officials in the companies, who were not named in indictments against the industry, actually played a part in widespread conspiracies to fix prices and allocate market on sealed bid business. Last week, it appeared the Justice Department was interested in the same thing. By midweek it was firmly established that a federal Grand Jury in Philadelphia was hearing testimony from officials named in the government indictments, aiming to see if top officials were involved in the conspiracies.

Paxton was Ginn's immediate superior at the time Ginn was first introduced to meetings among competitors, but Ginn denied Paxton had any knowledge of the meetings with competitors because sales people were "completely isolated" from manufacturing personnel.

Ginn said he had twice been advised by Ralph J. Cordiner, GE chairman, to obey company policy regarding competitive meetings and the antitrust laws: once when he was named general manager of the transformer division in 1954 and again when he was named vice president and general manager of the turbine division in 1957.

After the second warning, Ginn said, he believed Cordiner meant it, and although he acknowledged that between 1954 and 1956 meetings were held on a "spasmodic basis," he ordered men in his division to stop them and to adopt a "leprosy" policy of keeping away from competitors altogether.

Sen Kefauver said it was his information that about 40 meetings were held by employees of the turbine division between 1957 and the time the grand juries started meeting, but Ginn denied any knowledge of them.

Biggest point of controversy developed thus far is an alleged meeting at GE's Philadelphia switchgear plant in 1958 between Arthur F. Vinson, vice president and group executive, and George F. Burens, former vice president in charge of the switchgear division, with three of his department managers. Burens claimed Vinson ordered the switchgear division to meet with competitors and stabilize prices at this meeting. But Vinson denied he gave such an order and claimed he never attended such a meeting. He further disclaimed any knowledge of GE executives meeting with their counterparts in competing companies.

Noting the direct conflict in testimony, Sen Kefauver remarked, "I think this is important and we will send this record down to the Department of Justice and let them try to ferret out the truth about it." Commented Sen Philip A. Hart (D-Mich.), "Well either somebody is crazy or somebody is lying."

More conflict came in testimony of Raymond W. Smith, another former GE divisional vice president, with that of Vinson.

Smith said Vinson, Paxton, Mark W. Cresap Jr, president of Westinghouse, and A. C. Monteith, Westinghouse vice president, met during a trade meeting in Boston in 1958, "at which time transformer prices were discussed."

VINSON

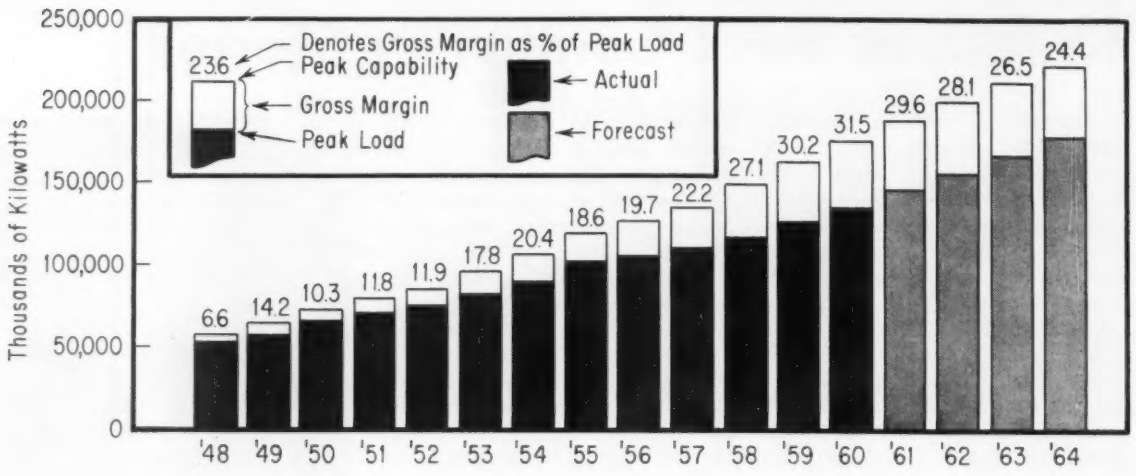
Smith said Vinson told him about the meeting afterwards, and "it was my impression from the discussion with Vinson that the air had been cleared somewhat." At the time, he had not been meeting with competitors, but "that same afternoon," Smith said, he contacted a Westinghouse official and had a "general discussion of prices.

"It was my feeling, my sense of what the conversation was, that I should go back to discussing these matters with competitors so I did so that afternoon," Smith said, recalling the discussion with Vinson.

Vinson Tells of Meeting

Vinson acknowledged the top-level meeting between GE and Westinghouse officials took place in 1958, but he said there was no discussion of prices. Both Paxton and Cresap were new at their jobs and it was a social get-together according to Vinson.

Another breakdown in communications was revealed in testimony of Smith and Vinson. Smith recalled that sometimes after meetings with competitors in New York he would drop into Vinson's office and mention that he had "met with the clan." Vinson said he never recalled Smith using the phrase but did recall one point where Smith had told him he was taking new GE transformer plans around to "show them to the boys." Vinson said he thought that reference was to GE's sales people and to their customers.



EEI Optimistic About Future

Power survey forecasts new highs this year, estimates growth rates for five and 16-year periods up to 1964

Despite the recession, the nation's electric power industry is expected to hit new highs in output and generating capacity this year.

Edison Electric Institute's semi-annual power survey estimates output for the total electric utility industry in contiguous United States will reach 819 billion kwhr by the end of '61—an increase of 7% over 1960's output of 765 billion kwhr. This should climb to a trillion kwhr by the end of 1964, the study indicates.

Generating capability, on the basis of median hydro conditions, is expected to reach 187.8 million kw in December—an increase of 7.4% over the 175-million-kw capability in December 1960. By the end of 1964, total capability should reach 220.7 million kw—an average annual increase of 6.2% for the five-year period from December 1959.

Summer '64 Capability Predicted

Based on median hydro conditions, 1964 should see a summer capability of 217.5 million kw—representing an average annual growth of 6.4% for the same five-period.

The chart pinpoints that, with 220.7 million kw attained by the end of 1964, there will have been a 6.2% average annual rate of increase for the five-year period from 1959 and an 8.8% average annual increase in the 16-year period from 1948.

Capability forecasts through 1963 in Regions 1 through 5 are about the same as the previous report last October. Regions 6, 7 and 8 have higher capability forecasts than they did six months ago. But for the eight regions together, differences are negligible.

Other trends indicated by the survey:

- Winter peak load should hit 144.9 million kw in December—8.9% higher than last year's 133 million kw. The 177 million kw forecast for December 1964 represents an average yearly increase of 7.2% in the 1959-'64 period. The 16-year period shown above has an average annual increase of 7.8%. (An average annual increase of only 7.2% represents a doubling in ten years.)

Except for Regions 6, 7 and 8, where peak loads show an increase in some years, forecasts for peak loads are 4% lower than they were last October. The over-all winter peak load forecasts through 1963 show reductions up to 1.5%.

- Summer peak load in 1964 is expected to be 179.3 million kw—an average annual increase of 7.4% for the 1959-'64 period. Summer peak load in 1964, for the first time, is expected to exceed the December peak by about 1%.
- December and summer regional gross margins, with some exceptions, are somewhat higher for 1961-'63 than indicated in previous surveys. This results from the downward revision of peak loads, generally with minimal change in corresponding capability forecasts.

Gross margin will drop from 29.6% for December 1961 to 24.4% for December 1964. Likewise, summer gross margins will drop from 28.4% to 21.3% over the same period.

Six A-Projects Underway

In the atomic electric power field, six projects with combined nominal rating of almost 400 Mw are already in operation. Before the end of the year, five additional projects with a combined nominal rating of about 330 Mw are expected to go into operation.

In addition, there are 13 other nuclear plants in various stages of planning or construction. They have a combined nominal rating of 1.4 to 1.5 million kw.

All told, the nominal capacities of these 24 projects total over 2 million kw.

Price lists for the survey are available by writing Edison Electric Institute, 750 Third Ave, New York 17, N. Y.

Columbia Pact Worries Canadians

NWPPA told by Williston that impression of unequal benefits exists in Vancouver; Hanford, Nez Perce, and other possible power sources discussed at meeting in Wenatchee

The "rapid and almost unanimous ratification" by the US Senate of the proposed US-Canada treaty for upstream development of the Columbia River may delay Canadian ratification of the treaty, the Northwest Public Power Assn was warned at its recent annual meeting in Wenatchee, Wash.

Ray G. Williston, British Columbia minister of lands and forests and a member of the BC Power Commission, noted that "the speed of this action, when coupled with an incorrect interpretation of the division of benefits, leaves the impression in opposing groups that Canada has not entered into a fair agreement."

Public Opinion Important

US news reports that the US would gain more than Canada from the treaty have been widely circulated north of the border and contribute to the misunderstanding, said the Canadian official. Public opinion is important, said Williston, for "BC Hydro must support its applications for water licenses in public hearings in the sensitive areas" which will be flooded by dams to be built under the proposed treaty.

Even with favorable public opinion, ratification will be slow, as licenses for the Duncan Lake, Mica and Arrow Lakes dams cannot be requested until completion of formal engineering studies on the three projects. Agreement also must be reached between the Canadian federal and BC provincial governments on financing and operating the projects. Williston predicted, however, that "many important decisions will be made in the next four to six months" and expressed confidence these decisions will enable construction to start.

British Columbia was one of several power sources eyed by the 115 public and cooperative systems comprising the association, others being a nuclear reactor at Hanford, Nez Perce Dam on the Snake River, and Libby Dam on the Kootenai River.

Conversion of a Hanford reactor to produce an estimated 650 Mw at about 4.5 mills is economically feasible, the convention was told by W. E. Johnson, general manager for GE's Hanford Atomic Products operation. Johnson admitted, however, that the economics are "elusive" and are based on some very important and basic assumptions that can be made only by the government on matters such as the length of the period during which plutonium production is required.

Owen W. Hurd, managing director of the Washington Public Power Supply System, lauded the 2,100-Mw Nez Perce Dam as "the recognized key to the comprehensive development of the Middle Snake" but accepted Interior Secretary Stewart Udall's recommendation to the FPC that approval of a license for either Nez Perce or High Mountain Sheep be delayed for further study of fish passage facilities. At Hurd's suggestion the convention adopted a resolution commending Udall and Pres Kennedy for proposing a crash program for the early solution of fish passage problems in the Columbia River System.

Libby Dam Recommended

Major General Alfred D. Starbird, North Pacific Div Engineer for the Corps of Engineers, described the 350-Mw Libby Dam as "one of extreme interest to us at the present time and one we hope will go forward most rapidly." He estimated that four years would be required for planning and another six or seven for construction.

Although heartened by statements from such speakers as Kenneth Holum, assistant secretary for water and power in the Dept of the Interior, that "a new golden era in power" is ahead for the Pacific Northwest, the convention expressed considerable concern over competition from investor-owned power. Three resolutions dealt with this problem.

One opposed the proposed merger of the Pacific Power & Light and California-Oregon Power companies, another opposed "construction of any private electric company transmission line which would duplicate the transmission lines of the Bonneville Power Administration," and the third urged the Secretary of the Interior to oppose the license application of Montana Power Co for the Buffalo Rapids projects.

Investor-Owned Power Attacked

Investor-owned power was credited by Rep John Goldmark, a key Democratic member of the recently-adjourned Washington state legislature and a trustee of the Nespelem Valley Electric Cooperative, with an effective job of "infiltrating" the Democratic party in the state. Regarding Republican votes as "in the bag," it contacted Democratic legislative candidates before primary elections and helped them in their campaigns, thus winning many friends in the legislature, Goldmark contended.

Heeding Goldmark's advice that "you face a very grave political problem," the convention resolved to reorganize its legislative committee "to form a more united front" in political matters.

Power lines connecting major load centers occupied the attention of several speakers. Charles F. Luce, new BPA administrator, confined himself to the proposed intertie between BPA and California, now the subject of economic, engineering and legal studies, but several other annual meeting speakers ranged farther afield.

Alex Radin, general manager of American Public Power Assn, looked forward to the day "when we should think in terms of the interrelationship of the power resources of Alaska, Canada, the Pacific Northwest and the Pacific Southwest," while Pat Greathouse, vice president of the United Auto Workers, proposed the establishment of a nationwide power grid developed and maintained by the federal government.

R&D Can Cut Underground System

McDaniel tells PCEA E&O meeting increasing public interest in underground distribution should be anticipated

Greater progress can be anticipated toward reducing the cost differential between underground and overhead construction as distribution research and development expands, T. M. McDaniel Jr, Southern California Edison Co, told the Pacific Coast Electrical Assn Engineering and Operating Conference in Los Angeles recently.

Increasing public interest in residential underground distribution is apparent to all forward-looking utility managements, remarked McDaniel. Management realizes, too, that the public still wants dependable, economical energy. One way or another, we can be sure that our industry and its allies will develop a truly low-cost system which will provide service reliability with reasonable maintenance and the lowest possible capital cost, McDaniel concluded.

Sessions on underground distribution and computer use for engineering and control were among the most popular attractions for many of the 600 delegates in attendance. But interest ranged over many subjects with up to ten groups meeting simultaneously.

Carter Blankenburg, Southern California Edison, wondered when the underground distribution concept would really take hold. Most developers seemingly are not aware of the opportunity to improve developments at costs which appear acceptable to the public, noted Blankenburg.

UG Cost Under 2% per Home

Southern California Edison has found that net costs to developers for electric and telephone distribution, after pole line credit, are nearly always less than 1% where the house and lot costs more than $20,000. Where house and lot cost is in the $15-20,000 range, 2% should cover the difference, Blankenburg estimated.

He discussed two alternatives to pay the cost differential. One way is to have the developer, and subsequently the home owner, absorb the difference in capital costs. The other is for the home owner to pay an underground rate higher than that for overhead service. The latter arrangement could be troublesome, because the home owner must be continually sold on the value in the higher rate.

In a session with telephone representatives, Blankenburg cited jointly planned and built electric and telephone distribution systems as a substantial help in keeping costs down. There are now, he said, new opportunities for more cost cuts by using plastic duct and simplified trenching. Savings should come largely from reduced cost of stringing, joining, placing and stacking ducts.

Direct Burial May Not Save

Investigations show that "first cost" reductions gained by omitting ducts are not likely to amortize the retrenching necessary when cables are to be replaced, Blankenburg emphasized. Some 20 to 25 years ago SoCalEd experimented with a few small installations of direct buried power cables in residential areas. These were all in serious trouble within five to ten years, he concluded.

In the average combination electric-telephone residential job the cost of trenching and backfilling is 20%, ducts 40% and structures 40%. In heavy commercial areas these proportions are 12%, 32% and 56%. These average direct costs have been found from studies of many recent underground jobs, said J. W. Lauder, also of Southern Cal Edison.

The study showed that residential tract trenching costs from 58¢ to $1.25 per ft (including contractor's 15% overhead and profit) and the average job is 92¢ per ft. However, trenching is not the most expensive item, and we should concentrate on reducing duct and structure costs, Lauder maintained.

Jack H. Lawson, Pacific Gas & Electric Co, appealed for standardization of pad-mounted transformer cabinets. PG&E has designed a pad-mounted combination with separable transformer for 12-kv grounded wye. Cabinets or transformers supplied by different manufacturers can be used. This minimizes the spare transformers in stock and allows deferral of installation until homes are built, said Lawson.

Modular Plan Aids Pad Mounts

Operating requirements for pad-mounted transformers call for positive protection and sectionalizing combined with safe, economical load switching. This is easily accomplished with modular assembly, said H. J. Barta, S&C Electric Co. Each cable section is terminated at a disconnect switch, and each transformer is connected to the system through a disconnecting-type fuse. A faulted cable section or transformer can be readily isolated.

Advances in design, firing temperatures, capability and reliability of the gas turbine in the last five years, coupled with a considerable price reduction, has intensified interest in the combined cycle, stated C. E. Sutton Jr, General Electric. Furthermore, reliability of units in service has been at least 99.5%. He predicted that 15% of all steam plants built in the next 20 years will use the combined cycle.

Gas-Steam Cycle Saves Fuel

A 3.3% gain in efficiency was indicated for a 680-Mw steam and gas turbine plant in a recent study, said J. O. Stephens, Westinghouse Electric Corp, a 75-Mw gas turbine at 60F ambient was included for operation on gaseous fuel, with steam boilers fired from coal. The combined plant, using modular components, was a stand-off against a conventional plant of the same output at $97.5-million capital cost and 6 mills per kwhr for energy.

In the study design, two 25-Mw gas turbines drive, through step-up gears, external axial compressors which supply pressurized air to a 25-Mw combustor system and power turbine, producing 75 Mw. This allows the gas turbine-driven compressors and turbine exhaust to supply 100% combustion air to the

boiler if the generator shaft is inoperative.

The combined cycle is attractive to the utility which generates much of its energy with natural gas in large units, said T. M. Hotchkiss, Southern California Edison. He pointed out some factors which must be considered:

- Attractive financial inducements must counteract the reluctance to add complications to an otherwise conventional plant. In a SoCalEd study, he said, an arbitrary goal has been set for the combined cycle plant of $10 per kw capital costs and 400 Btu per kwhr reduction in station net heat rate at full load, compared to the 130-Mw, 2,400 psi, 1,050/1,000F units at Alamitos.
- Usually, primary fuel for the gas turbine is natural gas with treated residual fuel oil or distillate as alternates. A minimum pressure of 150 psig is an added parameter as many plants have natural gas available at lower pressures that are sufficient for steam boilers.
- Only selected fuel oil grades can be used in the gas turbine, and some pre-treatment is needed. A residual oil treatment plant costs several hundred thousand dollars and treatment costs about 4 to 5¢ per million Btu. The attractiveness of diesel oil or a refined distillate depends on the "firmness" of the natural gas supply.
- The gas and steam turbine portions of the plant should be capable of both combined and individual operation. When only the gas turbine is out, the steam portion should still be able to operate at maximum capability. Such arrangements should not be difficult with the usual operating force and added equipment must be minimized.
- As the combined plant requires less cooling water per kw, this is an advantage when cooling water is at a premium.
- The regenerative air heater is eliminated by the combined cycle. Instead there is an increase in economizer surface. This should be less costly and easier to maintain than the equivalent air heater surface. There may also be a space saving in capacity per sq ft.
- Inspection or overhaul periods of the two turbines will not coincide. The gas turbine manufacturer will probably want more frequent inspections if considerable oil is used than if gas alone is used.
- With the trend toward generating station automation, the gas turbine generator should be incorporated into the computer controlled program. This should not be difficult, but more space will be needed.

T. M. McDANIEL JR, Southern California Edison VP, explored underground possibilities. Also at speakers table, left to right, are H. J. Randolph, Randolph Engineering Co; Robert Bine, the Irvine Ranch; and R. C. Blankenburg, SoCalEd

Advocates Steam Peaking Units

Steam generator peaking capacity was discussed by C. F. Hawley, Riley Stoker Corp. He advocated a basic unit of high efficiency but designed for 15 to 40 or 50% increase in peak capability.

Certain operating characteristics can be tolerated for a short time overload but cannot be allowed for continuous operation. These include high heat release rates in furnaces, more frequent use of heating surface cleaning equipment, high absorption rates in steam producing areas, fans and fuel burning equipment nearly wide open with no reserve margin.

As an example, Hawley cited a coal-fired 150-Mw boiler now under construction which will have 17% reserve capacity at only 5% additional cost. Overload capacity is obtained by increasing primary steam flow 24%, pressure 10%, reheat flow 40% and reducing feed water 154F by removing top feedwater heaters. This produces a 40% increase in heat output.

D. A. Sandell, Rome Cable Div of Alcoa, reviewed the history of EHV conductor development and noted that both Bonneville Power Administration and TVA will erect 460-kv experimental lines this year. At Bonneville several conductors of 2.125-in. or larger dia will be tested.

Three bundles of 950-MCM ACSR 54/6 will be used in the TVA test. A 3-conductor bundle causes some mechanical spacer problems. However, a 3-conductor closed spring type spacer shows promise, said Sandell.

Interset towers will be placed between existing towers on a Southern Cal Edison 220-kv line when a second 1,033-MCM ACSR conductor per phase is added, said H. D. Fischer Jr. The intermediate towers are designed for transverse wind loading only and also act as props to hold the wire up in mid-span. This reduces tension per conductor by 50%.

Line sectionalizing procedures could be programmed on a computer in much the same way as generating station control, speculated Ernest A. Gissel, Arizona Public Service Co. When a permanent fault occurs, a computing device test program procedure would be put in service. Disconnect opening and line testing would be done automatically.

Gissel speculated that the ultimate in technique might result in the line fault analyzer being automatically connected to the line, locating the fault, and the computer typing out the exact location.

Taum Sauk Will Provide 350 Mw

Rigorous analysis proves out pumped-storage project over new steam unit as next system addition; 'lean project' concept plays an important role in the decision

GEORGE P. GAMBLE, Executive Vice President, Operations, Union Electric Co, St. Louis, Mo.

The Taum Sauk project consists of a relatively small reservoir perched on a mountain top, connected by a deep shaft and long tunnel to a power house on a not-very-large lake in a valley. This combination of elements makes a sensible pumped-storage peaking plant which will furnish up to 2.75 million kwhr of peaking energy per day and, starting from standstill, can be loaded to 450 Mw in 6 min total elapsed time. Behind the project thus simply described lies almost six years of effort and an expenditure of $600,000, which led to the economic justification of a $50-million, 350-Mw pumped-storage plant to be added to the 2.4-million kw system of Union Electric Co by June, 1963.

Pumped-storage hydro can be found attractive for peaking operations in areas where terrain and water conditions are suitable and where system size, characteristics, and interconnections make feasible a plant large enough to produce a satisfactory cost per installed kilowatt. These conditions were all met in Taum Sauk. Nevertheless, this project should by no means be taken as typical of all such plants. The author feels, however, that a contribution can be made by relating how Union Electric Co developed this pumped-storage installation and arrived at a decision to proceed with its construction.

Two considerations seemed to make pumped storage feasible back in 1953, when Union Electric started studying its practicability. Probably the most important was the announcement by Allis-Chalmers Mfg Co in 1950 of a reversible pump-turbine runner, making available in large sizes machines with only one hydraulic element capable of both efficient generation and pumping. A second important and related factor was that capacity increments to power systems are now large and becoming larger. Large size steam units have been fundamental in keeping down the cost per kilowatt of steam capacity additions, and these same economic factors apply to hydro installations.

Lean Project Concept Helps

Optimum economic results were obtained for pumped storage on the Union Electric system with the development of the "lean project" concept. Such a concept centers on a hydro addition with minimum reserve or flywheel and with minimum or no provision for future extension. Such a plant would be sized to fit a normal system capacity increment in the year of its installation and would employ the minimum number of units to achieve its required rating. Really powerful hydraulic units, which can be served by only moderate amounts of water, require high heads, preferably 500 ft or more. It is hard to over-accent the importance of the contribution which high head, economically attained, can make to a hydroelectric plant where the installed cost per kilowatt of machinery is basic.

The lean project concept evolved after a number of disappointing but thorough studies into the possible use of earth-fill dams, 200-300 ft high, and rather large upper lakes of 150,000 to 400,000 acre-ft. Such projects would require up to 1,000 Mw of capacity to produce favorable unit costs. This would mean construction in stages, a fundamentally uneconomic process in the case of hydro plants of this type. Step construction would be necessary, since at least ten to 15 years would have to pass before Union Electric and its interconnected neighbors would grow sufficiently to support this much additional peaking equipment. The possibility that adverse water conditions would seriously delay the initial filling of the reservoirs of an otherwise completed project ruled out several large-lake, low-head sites.

800-Ft Head Could Be Developed

The lean plant concept seemed possible of realization in the rugged granite terrain south of St. Louis in the vicinity of Taum Sauk Mountain, the highest spot in Missouri. By placing a lake on the top of Proffit Mountain, a head of over 800 ft could be developed to the East Fork of Black River nestled at the base of its western slope. The only real cost of obtaining this quite high head would be that of a tunnel and penstock between the power plant and the upper lake. This appeared economical compared to building any type of dam for heads of this magnitude. Size of the lakes involved and of the hydraulic transport facilities required were small enough to make economical con-

Taum Sauk Credits

Taum Sauk is the culmination of the efforts of many individuals who have worked with the author prior to and since the decision was made to proceed. The author wishes to acknowledge the important contributions to this end made by all Union Electric Co personnel associated with Taum Sauk.

Acknowledgment is also made of the great service rendered by Allis-Chalmers Mfg Co in furnishing data on literally dozens of combinations of pump/generator units for varying heads.

J. Barry Cooke, supervising civil engineer, Pacific Gas & Electric Co, and I. C. Steele, consulting engineer of San Francisco, provided invaluable help for rock-fill dam and tunnel work and other important aspects. The assistance of Dr Frank Nickell, consulting geologist of San Francisco, also was invaluable.

# of Peaking Hydro

struction seem quite probable. Furthermore, even in the driest year of record, the East Fork of Black River, with a minimum flow of 1 cfs, would supply five times the water needed for the initial fill.

With this gleam in the designer's eye, a pumped-storage installation, later called Taum Sauk, was projected on a preliminary basis and probable costs developed. The East Fork of Black River afforded a very favorable site for the lower reservoir which would be formed by a 60-ft high 360-ft long concrete gravity-type dam. This dam would impound about 6,400 acre-ft while inundating a surface area of but 395 acres. Only some 4,350 acre-ft of its storage capacity would be utilized in full operation, with a resultant maximum level fluctuation of 15 ft.

Lake Built on Mountain Top

No continuing diversion from the stream would be involved. A valved conduit of 2,000-cfs capacity would pass automatically the normal stream flows, which are less than this amount over 99½% of the time. There would be a free-crest spillway capable of handling 70,000 cfs flows.

The upper reservoir with a 4,350 acre-ft storage capacity would be formed on the top of Proffit Mountain. A basin about 50 acres in surface area and over 90 ft deep would be created by leveling off the central portion of the peak and dumping the quarried granite on the undisturbed bordering rock to form the retaining embankment. The dumped rock on the 1:1.3 inner wall slope would be covered by a 10-in. design thickness, reinforced concrete water seal. This lining, averaging about 18 in. in thickness, would be extended vertically above the top of the rock embankment to provide an 8-ft parapet wall. The basin floor would be treated by grouting and suitable surface material where necessary to render it impervious. Some 2,700,000 cu yd of rock excavation would provide about 3,700,000 cu yd of dumped-rock fill. The kidney-shaped dike containing the upper lake would be about one mile in perimeter. There would be no headworks in the ordinary sense of the word, the only requirement being means for vortex suppression.

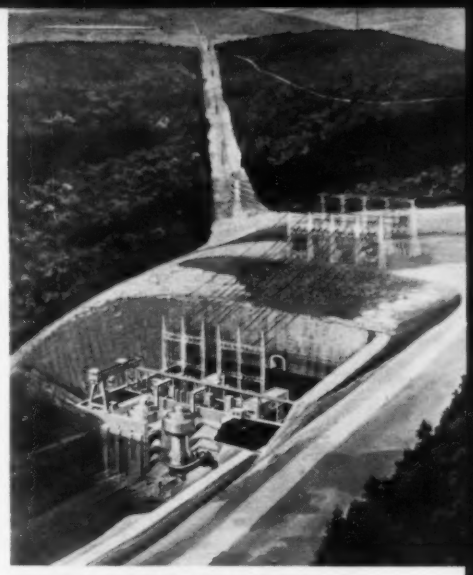
The solid granite underlying Proffit Mountain would be ideal for the 7,000-ft waterway between the upper reservoir and power station. Starting at the upper end, the conduit would consist of a 27-ft diameter vertical shaft 450 ft deep, followed by a horseshoe shaped section 25.5x25.5 ft, 4,750 ft long at 5.7% grade, then an 18.5-ft diameter steel-lined section 1,800 ft long at 0.5% grade. The steel liner would be necesary to withstand the 400-psi hydrostatic pressure at this depth below the upper reservoir.

The power station would house two of the most powerful hydroelectric units ever built. The two 175-Mw reversible pump-turbine units would be connected to the common tunnel by a bifurcated penstock section, and to the lower reservoir by a 1,500-ft long, 65-ft wide, open-cut tailrace. The station would be a typical reinforced concrete structure similar to hydroelectric plants of this general design using semi-outdoor construction.

The reversible pump-turbine six-blade runner of cast steel would be of the Francis type. Weighing 160 tons, it would be 21.5 ft in diameter and 8 ft high. When the plant is pumping at maximum output into a fully discharged upper pool, each runner would absorb 266,000 hp and deliver 2,530 cfs against 780-ft total dynamic head. When the two units are generating from a fully charged upper pool, under a net head of 830 ft and a flow of 4,400 cfs per unit, each runner would produce 335,000 hp.

Generator-Motors Over 180 Mw

The main generator-motors would be three phase, 13.8 kv, 200 rpm. Generator rating would be 204,000 kw at 60C rise and 234,600 kw at 80C rise, both at 1.0 power factor. Motor rating would be 179,130 kw at 60C rise and 206,000 kw at 80C rise, both at 0.9 power factor. The total length of a machine shaft would be 64 ft, the section between the turbine and the generator-motor having a diameter of 46 in. Each shaft would weigh about 375,000 pounds. The thrust bearings would each be designed for a load of more than 2 million lb.

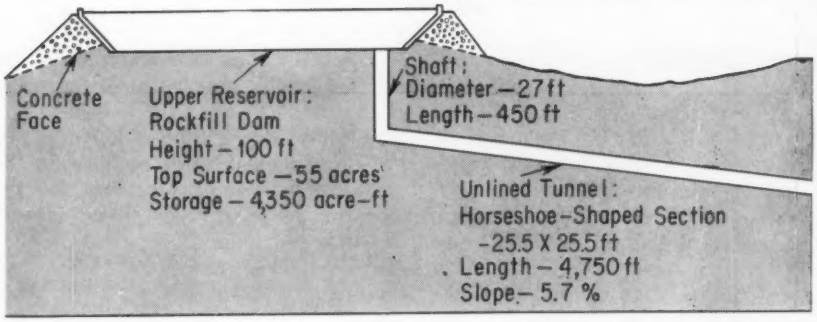


ARTIST'S CONCEPTION shows finished Taum Sauk project of Union Electric

A three-phase, 225-rpm, 12,000-hp wound-rotor induction starting motor would be mounted on the shaft of each unit just above the main rotor. This starting motor would bring the unit up to synchronous speed for pumping, or when it was scheduled for spinning reserve. A single liquid rheostat would serve the two starting motors. When a unit was scheduled as spinning reserve, the main unit would take over after the starting motor had brought it up to synchronous speed. A direct-connected exciter would be mounted on the shaft of each machine, immediately above the starting motor.

138-Kv Transmission Used

Taum Sauk would be tied to the Union Electric system via a double-circuit, 138-kv transmission line, 31 miles long to the transmission substation at Rivermines, Missouri. Each circuit would consist of two 477-MCM ACSR conductors per phase in bundled configuration. In addition, certain other circuits would have to be constructed now, rather than a few years hence when they had been planned for system development. The 44-mile rural portion of these would be of single-circuit wood pole H-frame construction, and the 27-mile suburban portion of double circuit steel, providing for



CREATION OF A LAKE on the top of Proffit Mountain will provide a head of about 800 ft to lower lake formed by damming East Fork of Black River

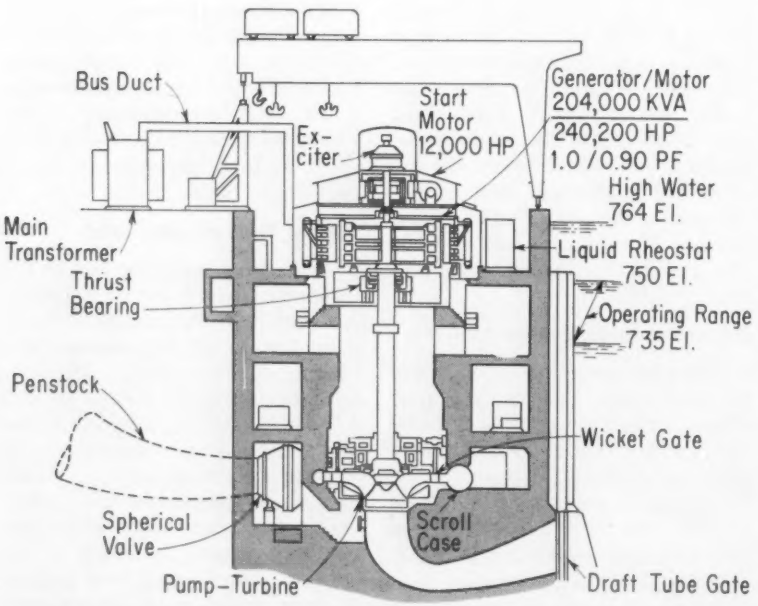
a future system tie.

Taum Sauk would be a completely automated plant, but with maintenance men on duty seven days per week on a one-shift basis. The plant would be operated by push button and microwave from the main control room at the Osage Plant and would be loaded by dial setting in the load dispatcher's office in St. Louis.

The start-up procedure for generating would be conventional and relatively simple, but starting the unit as a pump would be more complicated. The starting induction motor would bring the unit to synchronous speed after the runner had been dewatered with compressed air. The unit then would be synchronized to the system. To reduce surging, water would be injected through a special pipe so as to fill the runner from its periphery inwardly towards the center before relaxing the air pressure and allowing the tail water to rise to the bottom of the runner. Then the wicket gates would be opened and the unit loaded at a rate commensurate with system conditions, at least 15 Mw per min.

For service on the summer peak of 1963, Taum Sauk would be required to furnish 2,200,000 kwhr on a maximum responsibility day and would be rated at 350 Mw. The design would permit generation of 2,750,000 kwhr on complete emptying of the upper reservoir, with a minimum capability of 350 Mw. The 25% margin in stored energy would provide some operating flexibility. As the years passed and the energy in a 350-Mw peak cut-off decreased, the plant could carry a somewhat higher rating. When floating as reserve with full head available, the two units could pick up a load of some 450 Mw in about 90 sec. When started from standstill, with valves closed, the two units could be loaded to 450 Mw in 6 min total elapsed time. A typical night pumping cycle would range over 9.5 hr and absorb energy at rates up to 408 Mw.

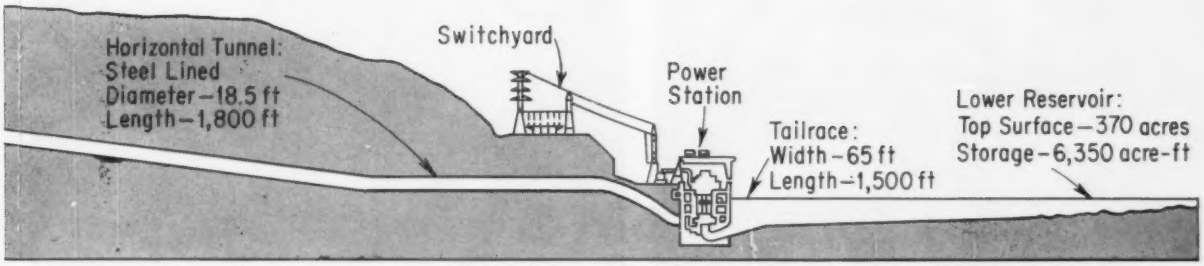
By early 1959 orderly system planning required that provision must be made for 350 Mw of new capacity on the Union Electric system by the summer of 1963. A conventional high-pressure, high-temperature steam unit would ordinarily have been installed. But analysis of the company's system, when taken together with those of the other members of its power pool, showed that 350 Mw of pumped-storage peaking capacity such as could be furnished by Taum Sauk would also meet system needs in 1963.



TWO OF MOST POWERFUL hydro units ever built will be housed in an outdoor-type power station. Each reversible pump-turbine runner will produce 335,000 hp under max. conditions of net head of 830 ft and flow of 4,400 cfs per unit

Capital Investment Governs

The controlling factor in the comparison of these two approaches was the difference in capital investment involved. Initial comparisons were based on conventional accounting, using straight-line depreciation, with accumulated depreciation reserves credited with earnings equivalent to cost of money. A schedule was prepared of capital requirements under each alternative, and this schedule



extended for a 12-year period.

Results were also compared on the sinking fund basis, pitting Taum Sauk's estimated cost against that of the average cost of four steam units, rather than against the very expensive initial unit at a new plant site. This sinking fund approach also minimized the distorting effect on depreciation reserve credits when facilities with such different life spans as in these alternates are compared in a short period study.

Has Low Manning Costs

By either method of comparison of capital costs, the advantage was to Taum Sauk, even though some two-thirds of the transmission costs charged to the job would have been required within three or four years for system development had the project not been built. Manning costs of a completely automated Taum Sauk were definitely in its favor, and these would grow greater over the years should inflation continue.

The major offset to these lower costs sprang from the fact that Union Electric basically did not need additional peaking capacity at this time. A considerable amount of relatively high-cost older equipment would still be in service on the system after 1963. This indicated that the competitive, efficient steam unit on base-load operation would be very helpful to the system's operating economy.

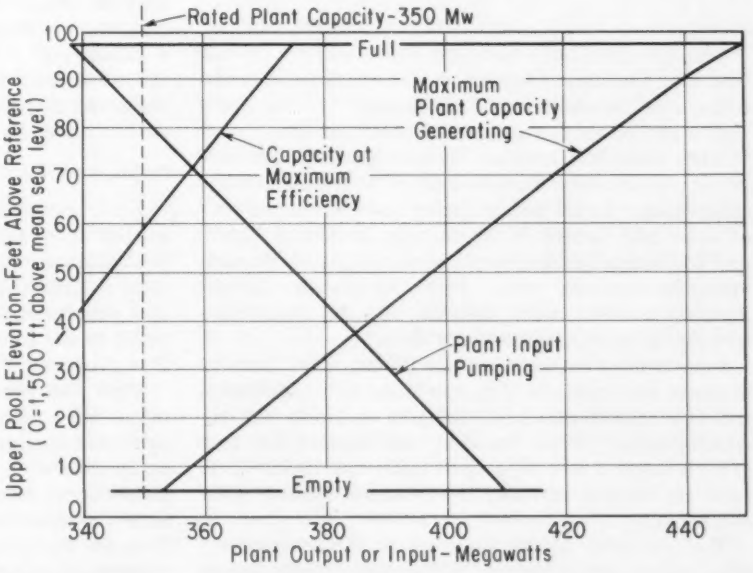
Installation in 1963 of pumped hydro would delay this benefit by two or perhaps three years. Thus a large penalty was incurred against the hydro project in its early years by foregoing the more than 2 billion kwhr of low incremental cost production which this steam unit would have provided.

Another penalty against pumped hydro would be the power lost in transmission and in the pumping-generating cycle. About 3 kwhr of off-peak steam generation would be required for each 2 kwhr of energy delivered to the system on-peak. However, the high-temperature-sensitive load on Union Electric's system causes peaking demands which would result in load factors on Taum Sauk of about 5% in the early years, decreasing to 2% or less in later years.

As a result of this low load factor, only some 10% of the energy penalty against Taum Sauk would arise from the inefficiency of the regenerative cycle, whereas nearly 90% of the energy penalty against pumped storage initially would be from the "steam unit foregone." This latter penalty component would decrease rapidly with time and would be overshadowed by manning savings alone after about 12 years. Specific factors were extended beyond the 12-year period, with a range of assumptions to establish that no reversal in economic balance which favors Taum Sauk might be expected in later years.

These economic comparisons of pumped storage and the new steam

(*Continued on page* 68)



PERFORMANCE CURVES of the pump-storage project illustrate the flexibility of of adapting hydro units for peaking operation for empty to full dam

PROBE gauges depth, torque applied being proportional to combined shear, compression, soil's plastic flow

ANCHOR is installed with minimum soil disturbance, the rod used as handle provides required leverage

Screw Anchor Gives Cheaper,

Minimizes digging, eliminates concrete slab in providing firm transformer mounts at new home developments; supports heavy load

RAY MARTIN, Chief Engineer, T&D Hardware, A. B. Chance Co, Centralia, Mo.

Machine-installed, screw-type metal anchors provide firm and economic foundations for ground-line transformers in the semi-buried distribution systems going into many of today's residential developments.

They were first installed about a year ago for supporting a unit-type transformer in a new real estate subdivision. Local rainfall being considerable, a pool of water had formed in the partially backfilled trench, and soil saturation hampered construction of the conventional concrete pad. Four foundation support anchors, however, were installed, and the transformer was put in service without any delay.

For, besides saving time and labor, these anchors dispense with concrete slab, minimize soil disturbance, and free transformer positioning of soil and weather contingencies. Once installed, the anchor has firm earth beneath it and hugging its sides, and its low L/R ratio can support considerable columnar loading without buckling.

Today's screw anchor grew out of the development of an earlier device for the US Post Office Department, which wanted an anchor for supporting suburban mail boxes without the conventional concrete pad. Determination of soil characteristics and their effect on the support capabilities of the anchor posed the major difficulties, rather than the anchor's configuration. When the soil bearing strength at the depth to which the anchor is sunk is a known value, the load that the anchor can support is easily calculated.

Early in the anchor's development, a means was devised for determining the subsoil condition without cumbersome digging or sampling. This instrument is a helical probe which is installed and retrieved by a ratchet wrench. The latter drives the sectional square shaft and has a torque wrench handle for measuring the force used to screw the probe into the ground.

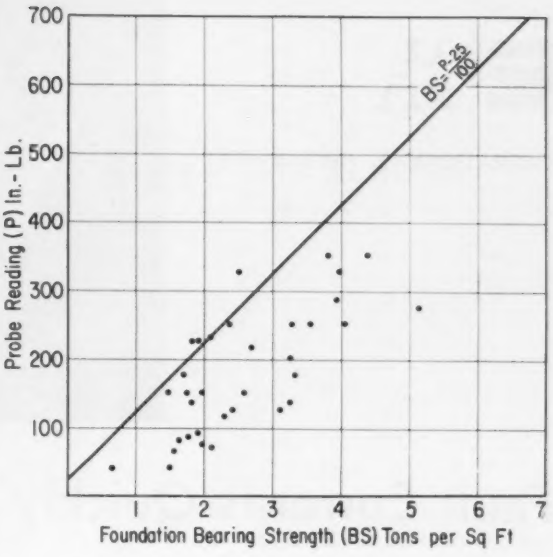
Probe and Formula Used Together

Each section of the shaft is 5 ft long and is marked at 1-ft intervals for measuring the depth at which readings are taken. When the probe is rotated, its head is pushed into the ground, displacing the earth as it penetrates the soil. The torque applied is proportional to the combined shear, compression, and plastic flow properties of the soil.

With the probe and formula $BS = (P-25)/100$, where BS = bearing strength of the soil in tons per sq ft, and P = probe reading in in.-lb, a crewman can easily determine the anchor size and depth. Actual installations, based on this formula, provide a safety factor comparable with the one included in the Swiss Hommer field tests.

Support anchors are installed to a depth where soil consistency is least affected by wetting, drying, freezing, and thawing. Unless conditions are unusual, that depth is 5 to 7 ft below the surface. As the foundation

UNIT-TYPE TRANSFORMER installed at ground level is supported by screw anchors for residential service



CURVE shows unconfined bearing strength of soil vs probe reading and helps fix optimum anchor size and depth

Faster Semi-Buried Distribution

anchors push against the soil beneath them, the probe reading must go 2 to 3 ft deeper. Thus the probe gauges the undisturbed soil in the loaded zone where any settling is marked by a flow of earth from beneath to the top of the anchor.

Resistance of the soil to movement of the anchor shaft gives lateral stability. The shaft for the unit-type transformer support anchor is galvanized steel pipe, which gives column strength as well as surface area for lateral stability. When four or more anchors are used for an installation, it is only necessary to assure close engagement between anchor shaft and the soil, soil disturbance being at a minimum.

Pilot Helps in Positioning

The anchor consists of a pilot, a 6-in.-dia (28-sq-in.) helix welded to a 5 ft length of 1½-in.-dia galvanized steel pipe, and a tapped square head with a ⅝-in. machine bolt and 1¾-in.-OD round washer. The installing wrench is a 2½-ft length of 1¾-in. seamless tubing, which engages the tapped square head of the anchor, and a 4-ft length of 1-in.-dia rod used as a handle to provide leverage.

The screw-type anchor ideally suits all requirements for a foundation anchor. No excavation is needed. As the anchor extrudes earth during its installations, firm soil is beneath it and hugging the shaft. Use of the long concentric pilot enables an installation crew to hold close center-to-center spacing and to position the anchors easily to match the support frame of various transformer sizes.

Foundation support anchors are available in cross-section areas of 12, 28, 38, 50, 70, 100, 143, and 176 sq in., so that a close balance can be maintained between any load and the bearing strength of the soil supporting it. This range of sizes, coupled with the use of the soil test probe for determining soil bearing strength, allows easy selection of optimum anchor size.

When the best size for the load and soil conditions has been selected properly, there is little or no settling of the foundation anchor. In the first installation, 3,540 lb are supported by four 28-sq-in. anchors where the soil test probe gave a reading of 175 in. per lb.

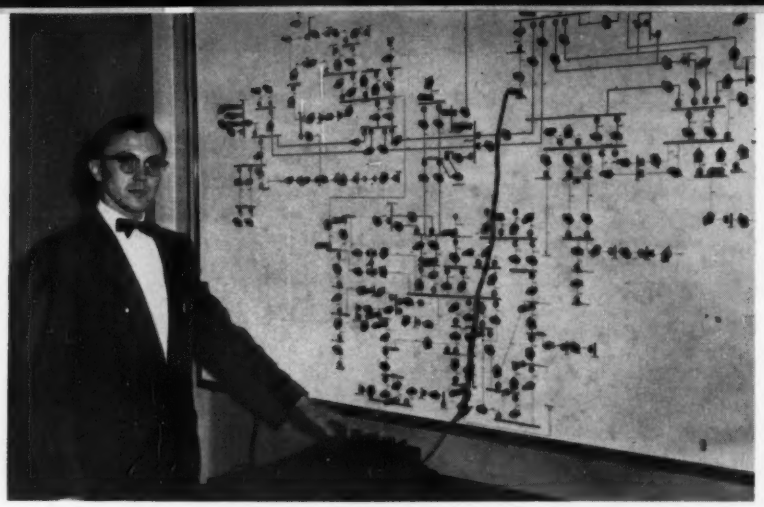
Using the formula (P-25)/100 gives a soil bearing strength of 1.5 tons per sq ft, or 20.8 lb per sq in. The four 28-sq-in. anchors, therefore, should support 4 x 28 x 20.8 = 2,330 lb. The actual load, however, is 3,540 lb, or 152% of the calculated maximum loading.

Most of the settling came with initial application of the load. After three days, the four anchors had settled 0.0065, 0.010, and 0.015 ft, with no movement thereafter.

Their ability to support and resist uplift simultaneously points to the application of the screw type foundation anchors as transmission tower footings. This use would allow the erection of tower or structure without the time and expense of making large excavations, pouring concrete, and waiting for the concrete to cure. Screw anchors appear to be applicable, in fact, for the support of anything within the practical limitation of helix size and the accompanying torque for installing them.

ELECTRIC UTILITY METHODS

OPERATIONS & TESTING



Fault Currents Quickly Spotted With Dc Board

A. F. GERSTL, Asst Relay Engineer, Orange and Rockland Utilities, Inc, Middletown, N. Y.

A job-fabricated, geographically-oriented dc board which simulates the Orange and Rockland system virtually eliminates the need for computations normally associated with determining fault currents at specific locations throughout the system. A major advantage of this board is that its lay-out is similar to the company's system operating diagram so that, with a minimum of effort, fault-current values throughout the system can be quickly determined with an optimum of accuracy. These values can be determined not only from existing generating facilities and interconnections with other utilities, but also can be determined from assumed hypothetical additional generation or interconnections.

In operational planning, when considering the installation of a new piece of equipment, e.g., a circuit breaker, or when determining the facility requirements of a new industrial customer, it is necessary to establish the fault-current value which will exist at the customer's tie-in point as established by the various surrounding generated or tie-line power sources. Also in system planning, when considering the installation of a new generating station, or interconnecting with an outside system, fault currents which would be imposed on the system's existing breakers and equipment must be reviewed. Occasionally, after expected fault currents have been determined, it is found that some of the existing equipment may need to be replaced because of excessive fault currents resulting from the added power source . . . and of course, the economic factors of such equipment replacement are significant to the planners' work.

Furthermore, there is a most frequent application of fault current values in calculating relay settings and proper fuse sizes at the various substations. Thus, both from an operational and from a system planner's point of view, a shortcut for quickly determining fault currents is valuable.

Short-circuit studies are generally based upon either one of the two most severe fault conditions, a 3-phase or a one-line-to-ground fault. The evaluation of such conditions is accomplished with the aid of symmetrical components. The positive-sequence impedance is used for calculations involving 3-phase faults. In addition, there is a negative-sequence and a zero-sequence contribution wherever one-line-to-ground faults are involved. Since the positive and the negative sequence values of the Orange and Rockland Utilities, Inc, system are equal, there are only two basically different sets of values to be represented: the positive and the zero-sequence impedances, to facilitate computation of the most severe conditions. It is beyond the scope of this article to elaborate on the zero sequence board built on the same basic concept as the positive sequence board described herein.

The dc board at O&R uses resistances to simulate impedances throughout the system. A vernier resistance is used in series with a basic resistance so as to allow better adjustment of simulated impedances. A Wheatstone bridge is used to measure the total simulated impedance of the system at any selected point. "Jacks" have been placed at strategic switching points so that the bridge can readily be plugged in and the readings obtained.

Actual impedance values of the system are represented in percentage on a 20-Mva base. The board is set up to give a reading of 1,000 ohms for each 1% of actual system impedance. The reading obtained at a specific "jack" point represents the percentage of impedance of the system at that point. Fault magnitude in kva is quickly determined by dividing that percentage of impedance value into two million and the fault current in amps is found by dividing a corresponding system voltage times square root of three ($\sqrt{3}$), into the obtained kva value.

The procedure for obtaining ground-fault values is similar. A reading of both the positive and the zero-sequence board has to be taken and the sum of twice the positive, plus once the zero-sequence value divided into 6 million to obtain the one-line-to-ground fault in kva.

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Mr. R. G. Wheaton, President
Line Material Industries
500 W. Michigan Street
Milwaukee, Wisconsin

Dear Rodg:

All of us here at Fargo join in extending to you and your associates our congratulations on this, Line Material's Fiftieth Anniversary.

For over thirty-one of these fifty years our companies have been closely bound together by a strong mutual respect for each other's interests and goals.

During this association we have watched with considerable pride Line Material grow and prosper to its acknowledged position today as one of the leaders in the electric equipment industry. Names such as "LM", "Kyle", "Round-Wound" and a host of others have become standards in the utility field. These accomplishments are the result of able management, creative engineering and research, good production facilities, and a splendid sales organization -- all involved have done a wonderful job and should be very proud of their achievements.

To Line Material Industries and all of its employees we convey our congratulations on your Fiftieth Anniversary and our best wishes for your continued success.

Most sincerely,

FARGO MFG. COMPANY, INC.

Stephen P. Becker, President

SPB/eb

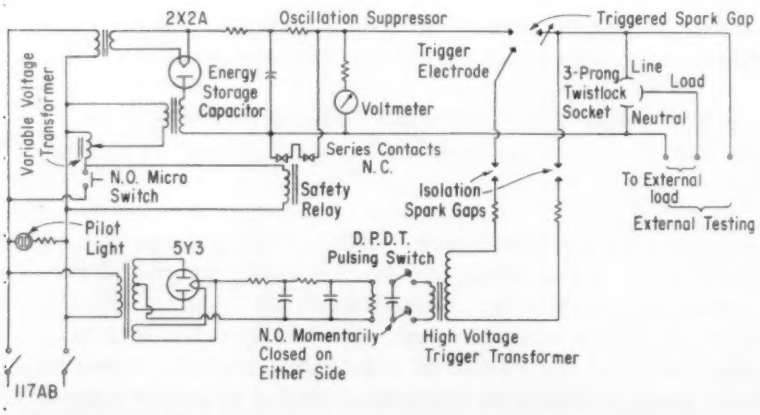
Two Sources of Photocell Failure Exposed

CHARLES A. HEINTZ, Associate Senior Engineer, Testing Section, Philadelphia Electric Co, Philadelphia, Pa.

Surges of several thousand volts and power-factor-corrected mercury vapor luminaires have dealt a death blow to many cadmium sulphide type photocell street lighting controllers. Tests conducted in the Philadelphia Electric Co laboratory have uncovered these villains and led the way to rendering them harmless.

The program began with the careful examination of the photocell controllers replaced because of damage in service. Most of them showed evidence of overvoltage on the cadmium sulphide photocells. These cells are extremely sensitive to excessive voltage of even a few microseconds duration. The fact that all cells showing this type of failure had been removed from overhead circuits and none from underground circuits suggested this overvoltage might be due to transients induced in the secondary distribution from a lightning stroke in the area. Later, it was discovered that switching surges also caused this type of photocell failure.

Photocell controllers were then equipped with low-voltage lightning arresters, which corrected the worst cases of damage. Although the number of failures then dropped considerably, it was noted that an appreciable number of overvoltage failures still existed. It was then demonstrated in the laboratory with a small surge generator that only a few surges, just under the threshold of the best low-voltage type arresters, could cause photocell failure. Vulnerability to these surges was found to be greatest when the photocell was in darkness and the load circuit was a high impedance, such as a burned out incandescent lamp or the reactor of a mercury-vapor luminaire. A low-impedance lamp circuit tends to alleviate the condition to some degree.



SCHEMATIC DIAGRAM of high-voltage pulse tester shows triggered spark gap and 3-prong socket for insertion of the control. Both are shown at upper right

SURGE TESTER IN OPERATION has street light control plugged into chassis (left front) and fixed-gap surge tester and discharge capacitor (right front)

Several Schemes Not Successful

Many schemes were tried to correct the failures due to surge voltages under the lightning arrester's threshold. The gaseous arrester was unsuccessful because most of the surge voltage had passed before the gas could ionize. Small point-gap arresters also failed because successive surges burned away the points, raising the operating value. An R-C circuit across the sensitive cell seemed to absorb the leading edge of the surge, but the remaining energy was sufficient to damage the photocell.

One successful solution, demonstrated in the laboratory and later in the field during the lightning season, uses one varistor across the cadmium sulphide cell and another across the low-voltage arrester. This arrangement was proposed by Karl Frank of Micro-Balancing, Inc, and used in their Mark 1 Photocell Street Light Controller. The varistor has the property of a rapid decrease in resistance when a surge voltage is applied and effectively bypasses the controller and its photocell for the duration of the excessive voltage. Surge current is limited by a series

resistor to a value which will not damage the varistor or the switching unit.

The surge tester developed for this investigation comprises a variable high-voltage dc power supply, a high-voltage capacitor, a calibrated spark gap and a socket for the street light controller. The capacitor is charged by the dc high-voltage supply to a pre-set value, and the spark gap discharges the surge current into the street light controller circuit. The surge generator is readily portable and may be powered from any 120-v appliance outlet. This surge tester may be used for many other insulation tests for either electrical units or their components.

Initial installations of power-factor-corrected mercury vapor luminaires caused a larger percentage of photocell controller failures. Switching contacts were badly pitted or contacts were actually welded together. It was first suspected that the inrush charging current of the capacitor was the cause. However, extensive tests failed to reveal an inrush of sufficient magnitude to cause this type of failure.

Further tests finally revealed the culprit. When the switching contacts break the circuit at the instant the line voltage is near peak value, the capacitor will remain charged at this peak value. The open contacts, half a cycle later, will then be subjected to over twice line voltage. The air between the contacts will be ionized from the previous arc, and should the contact spacing be too close or contact opening too slow, the excess voltage will cause the arc to restrike. The capacitor will then discharge across the contact gap and recharge with the opposite polarity, resulting in a very high current across the contact gap. The resulting high temperature will pit or weld switching contacts that are relatively close together.

This type of failure results from the coincidence of several occurrences, and therefore happens infrequently. However, once, or at the most a few times, is sufficient to doom a photocell street light controller. As the photocell characteristics limit the energy available for switching, practically all photocell controllers have the close contact spacing which contributes to the susceptibility. The remedy for this contact failure is very simple—maintain a contact spacing of at least 10 mils and insure a fast contact break.

The knowledge gained in surge testing and contact restrike tests should contribute to improved design of photocell controllers of all manufacturers. By constantly seeking out the cause of these and future failures, engineers can raise the reliability of this relatively fragile device to the standard expected of other utility system components.

Solid-State Device Converts Dc to Ac

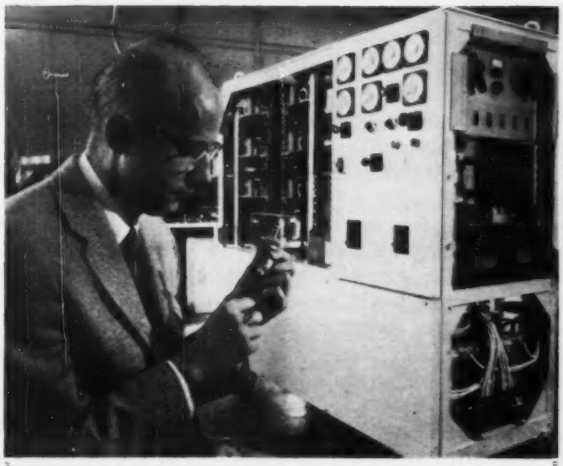
A working model of a high-capacity electronic device for converting direct current to alternating current has been developed in General Electric Co's general engineering laboratory. The solid-state device has a 50-kva capacity and has no moving parts other than two fans.

The inverter will help solve what has been a difficult problem in development work on new power sources—that electric power generated by sources such as fuel cells and solar energy is in the form of direct current. Most applications require that this be converted.

Actual conversion of power from dc to ac is accomplished by silicon controlled rectifiers which operate instantaneously and require no warm-up. The ac power output is provided at frequencies varying from 50 to 500 cps. Adjustable frequencies are easy to obtain with the solid state inverter.

The unit consists of two 12-phase bridge inverters. Output voltages of each of these inverters can be varied in phase, with respect to one another, to control the total output voltage. This scheme provides excellent output wave form. The output frequency is determined by a unijunction oscillator which fixes the inverter's gating rate.

The inverter should be especially useful, because of its low maintenance requirements, in isolated installations which must operate unattended. It can do the work of a 60-hp m-g set which is almost three times as heavy.

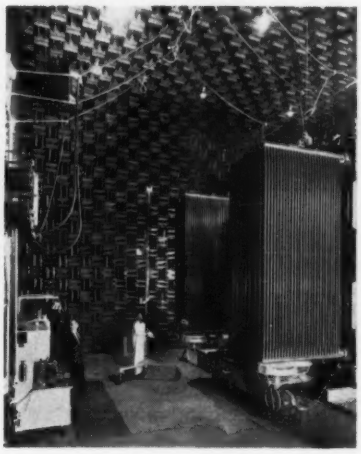


Basic Specifications

Input — 125 v dc
Output — 50 kv, 50 to 500-cps adjustable frequency, 120 to 240 v, 3-phase
Accuracy — ±1% voltage, ±0.5 frequency
Efficiency — approximately 90%
Output wave form — sinusoidal, less than 5% total harmonics
Rectifier rating — 50 amp each

News of Manufacturers

Transformer Noise Cut



A new method of reducing sound produced by transformers—by "uncoupling" of vibration-energy conducting paths within the transformer—has been developed and successfully applied, according to the Pennsylvania Transformer Division, McGraw-Edison Co, Canonsburg, Pa.

Vibration energy, generated in the core of a transformer, reaches tank surfaces through the liquid insulator and through the core supports—both efficient conducting paths for vibration energy. By destroying the effectiveness of these conducting paths, some of the vibration energy does not reach the tank surfaces where it would be radiated as sound.

According to Penn Transformer's engineers, the new sound-reduction method utilizes "compliant elements" which introduce a resilient medium in the liquid path. The core-and-coil assembly is uncoupled from the tank at points of support by "floating" the assembly on springs or other suitable supports.

The principles of the compliant-element system of sound reduction are said to have been established by extensive tests on models in Pennsylvania Transformer's Thomas A. Edison Acoustical Research Laboratory, and by application to production transformers (only to core-form units to date). Sound-level reductions of 8 to 12 db are being secured consistently.

Experimentation is still continuing on materials, shapes and arrangements of resilient gas-filled enclosures—the compliant elements of the system. Application to a transformer is said to have little, if any, effect on its size or weight.

Steam Generated at Plutonium Plant

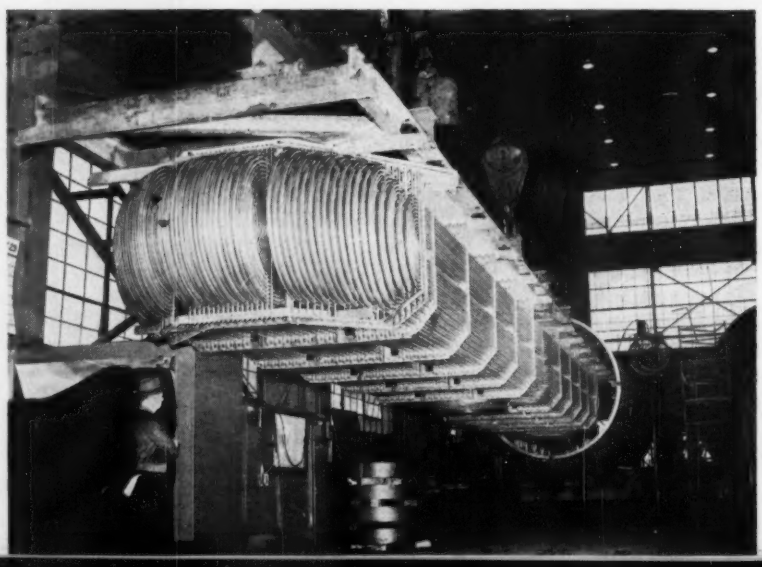
Combustion Engineering, Inc, has announced the shipment of the first of ten steam generators to serve the Atomic Energy Commission's New Production Reactor at Hanford Works, Richland, Wash. It is said that the steam produced by the generators could serve a 700-Mw electric generating facility. This would make Hanford by far the largest nuclear power plant in the world. Power produced will be one-third more than the output of the huge Bonneville Dam nearby on the Columbia River. Supplied under a $4.3-million contract, the steam generators will produce steam with heat obtained from heat dissipation system of the Hanford plutonium-making plant.

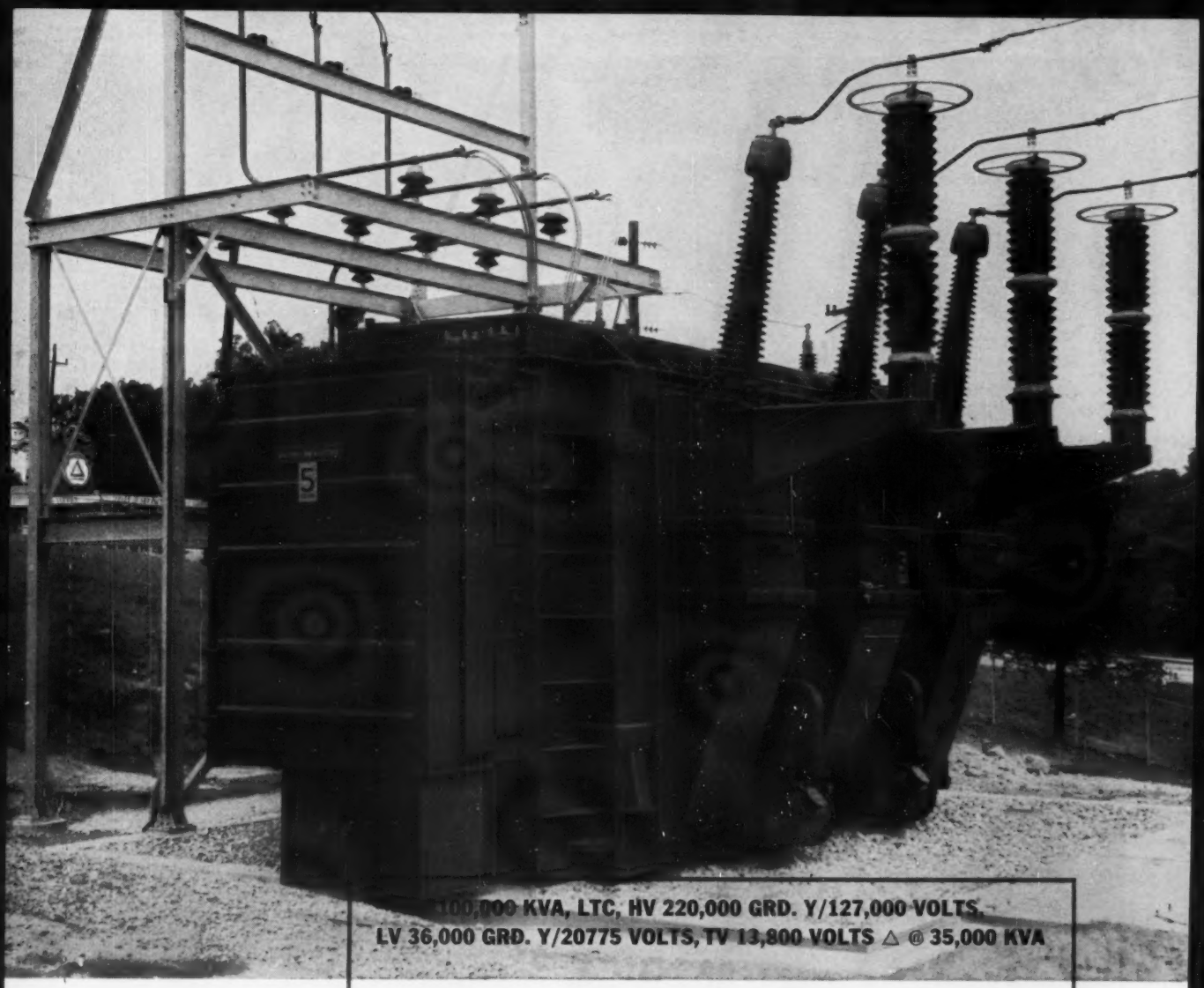
Each of the steam generators is 10 ft in dia, 57 ft long (with a shipping weight of nearly 170 tons) and contains about 20 miles of stainless steel tubing. Design conditions of the steam generator are: water side 1,825 psig, 600F; steam 800 psig, 600F. Actual operating conditions and lb/hr steam output are "security classified." High quality stainless steel tubing is used because the radioactive environment requires high corrosion resistance and maximum reliability.

Called the CE Tube Manifold Steam Generator, the unique steam producer is a completely shop- assembled, welded unit. The generators are cylindrical vessels with elliptical heads (with 16-in. manways). This pressure vessel contains both the steam-generating surface and steam-separating equipment. A cylindrical, centrally located tube manifold is used instead of the conventional tube sheet.

It is said that this new generator may be used in conventional power plants requiring large amounts of high-pressure, high-purity steam.

Steam generator "specs" were prepared by Burns & Roe, Inc.





100,000 KVA, LTC, HV 220,000 GRD. Y/127,000 VOLTS,
LV 36,000 GRD. Y/20775 VOLTS, TV 13,800 VOLTS △ @ 35,000 KVA

Power on the Potomac

100 MVA, 220 KV, Moloney LTC Transformer installed at Potomac Electric Power Company's Takoma Substation #27. This unit was placed into service by PEPCO in 1960, ten years after they had installed Moloney's first LTC Transformer, a 3750 KVA unit. The design principles of Moloney LTC are still the same and have been proven by a decade of service. Two of the main principles of Moloney LTC are:

1. All arcing is confined to special arcing contacts on the load transfer switch eliminating maintenance of selector switch contacts.

2. The exclusive, patented, reactor by-pass arrangement eliminates reactor loss and reduces voltage drop on non-bridging positions.

For additional information on Moloney LTC equipment request Bulletin LTC 2907. Contact your local Moloney representative on all transformation requirements.

ME61-8

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Manufacturers of Transformers for Utilities, Industry and Electronic Applications

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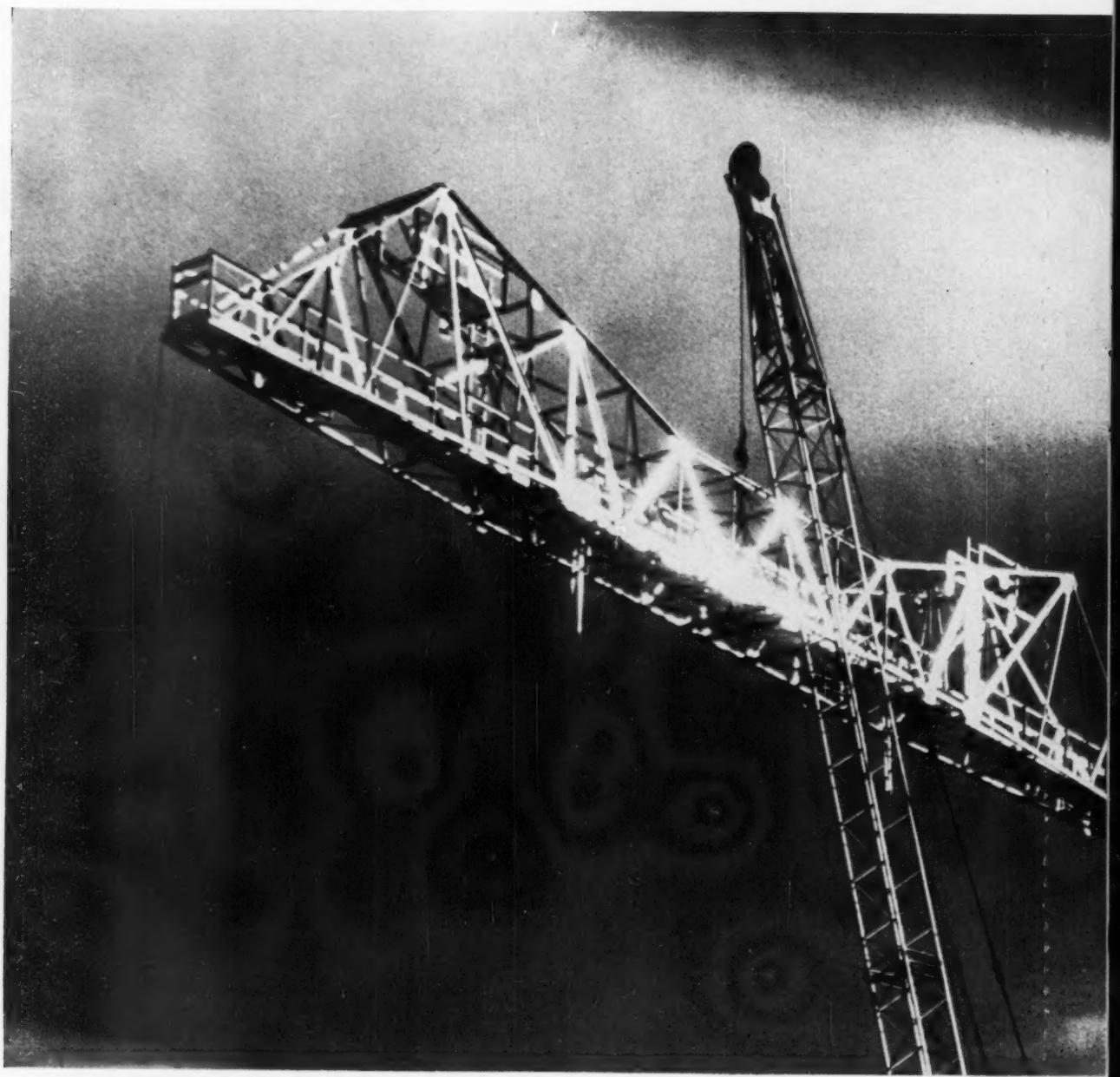

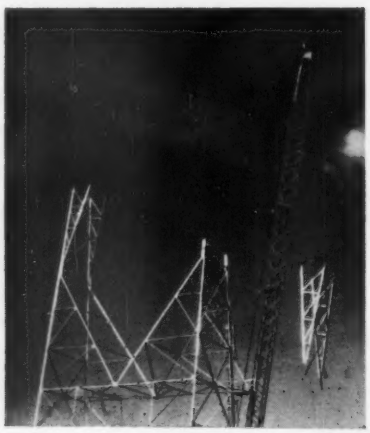

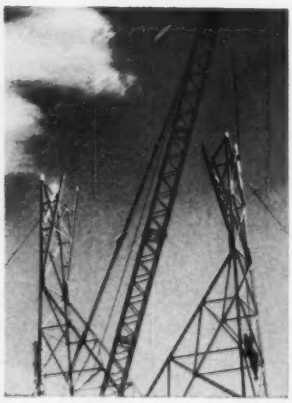

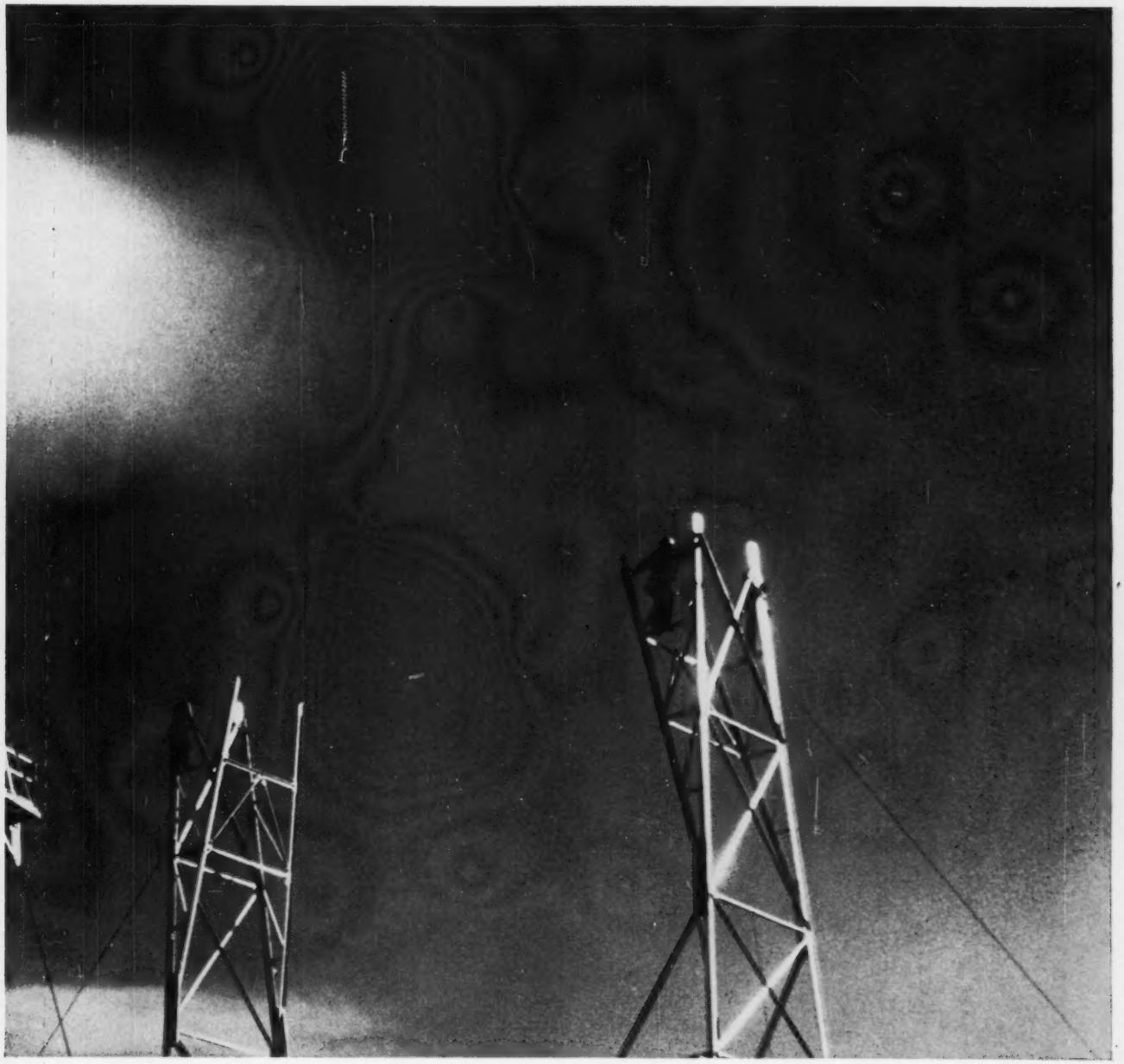

Alcoa Structural Division designs and fabricates aluminum towers that can be **erected fast—often in a matter of hours.** Lightweight aluminum towers (and substation structures) can be manufactured economically and require no maintenance.

Write: Aluminum Company of America, Structural Division, 871-E Alcoa Building, Pittsburgh 19, Pa.

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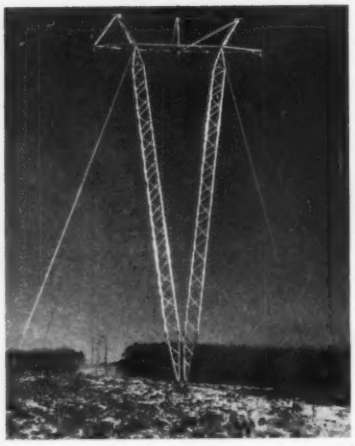


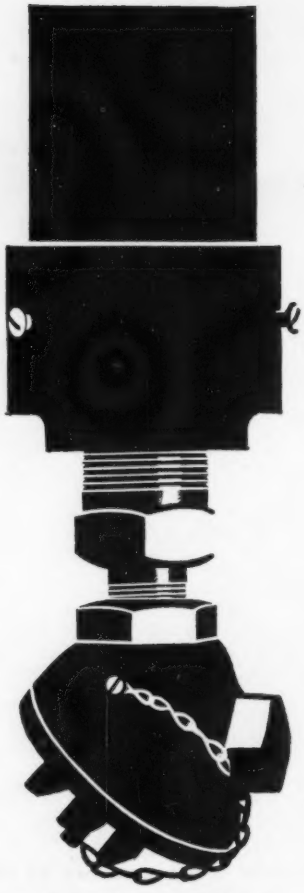
Alcan V-Guyed Towers Achieve 80% Weight Cut

Sterling Steel & Supply Co of Denver, Colo., has been appointed regional distributor for guyed V aluminum Alcan V-guyed transmission towers, it was recently announced by C. C. Armstrong, product manager for Michael Flynn Manufacturing Co of Philadelphia. The Denver firm will assemble aluminum components and offer engineering assistance in the erection of the lightweight structures. According to the manufacturer, the guyed V towers offer a weight reduction of up to 80% less than rigid steel towers and are adaptable to all types of terrain without the additional costs normally expected with adverse footings and side-hill conditions.

Components can be delivered to the erection site by surface vehicles or by helicopter and are readily assembled by ground crews without need for auxiliary equipment. Standard 20-ft leg sections weigh less than 200 lb each. Inexpensive yard assembly of the major pieces can considerably cut installation field time at the site. Conventional turret derricks or aerial lifts erect the structure initially with simple winch and A-frame hoisting the structure to vertical in minutes.

ADS Controls Turbines

General Electric Co's Automatic Dispatching System (ADS) will help control six of the largest turbine-generators in Southwestern Public Service Co's four-state distribution



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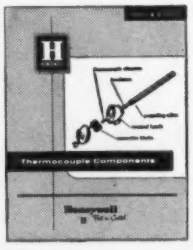

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area. Southwestern's power plants tied together by the ADS will include Plant X, three turbine-generators; Cunningham Station, one turbine-generator, and Nichols Station, two turbine-generators. Plant X and Nichols Station are located in Texas while Cunningham Station is located in New Mexico.

Besides using the ADS to control the turbine-generators, Southwestern Public Service will feed the ADS equipment additional data about what is being done at other generating plants in its operating territory.

Installation of the GE system is expected to be completed by the end of 1961. Cost of the system will be about $100,000. ADS is a development of GE's Instrument Department, West Lynn, Mass.

MANUFACTURERS BRIEFS

• **Sikorsky Aircraft** recently announced the design completion of the S-64 all-purpose transport helicopter, the first of a series of turbine-powered heavy-lift aircraft. The S-64 is the successor to the S-60 Skycrane, a piston-driven experimental helicopter which has successfully demonstrated its unique lifting capabilities on utility applications throughout the East.

Powered by two Pratt and Whitney JFTD-12 gas-turbine engines, the S-64 will have a payload capacity of eight metric tons or about 17,600 lb. Present plans call for the construction of three of the helicopters, one as a company aircraft and two for the German military. The first aircraft is expected to be ready for flight testing by the end of the year. The P&W engines will each develop 4,050 hp and provide a built-in growth potential to 12 tons' payload capacity. Future crane designs will lift up to 40 tons.

• **Air Preheater Corp** is currently installing two Ljungstrom air preheaters at Duke Power Co's new No. 5 boiler unit at Allen Plant, Belmont, N. C. Weighing about 512,000 lb each, the units will increase the efficiency of the new 1,800,000 lb-per-hr pulverized coal-fired boiler—it is said that Duke Power expects to save about 10%

(*Continued on page* 93)

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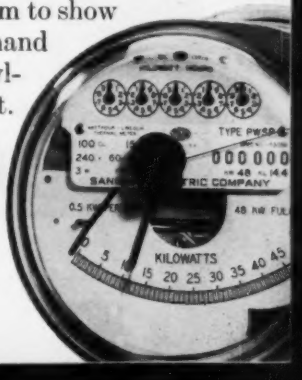
New from Sangamo—singlephase and polyphase combination kwh/thermal kw demand meters with the moving system that *floats* on a magnetic field created by specially bonded Alnico magnets.

The singlephase J3T combines Sangamo's new J3 watthour meter and the Lincoln watt demand meter into a single unit. PW polyphase meters combine Sangamo's new P20 two stator watthour meters with two element Lincoln watt demand meters. The magnetic floating system further increases the established dependability of these combination thermal meters.

These new meters are compact and use conventional round covers. They retain the proven advantages of previous Lincoln demand meters: independent watt demand and watthour measurement, dual range, sectionalized construction, and interchangeability.

Your Sangamo Representative has the full story on both the J3T and PW meters. Ask him to show you these new developments in demand meters from Sangamo . . . the acknowledged leader in demand measurement.



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Wagner® Network Transformers are designed to give you smaller, lighter units, with smoother contours for easier maintenance. In new networks you can cut system costs by constructing smaller vaults to hold these space-saving transformers. In older systems you can put larger ratings in your present vaults. Maintenance costs are less, too. The corrugated radiators can be quickly cleaned from above, and an anti-corrosive tank finish protects exterior surfaces for years. A special undercoating on the base protects the transformer even under adverse conditions of underground installation.

CORRUGATED TANK-COOLING SURFACES eliminate dirt-catching corners. Radiating surfaces are easy to clean, and there are no hard-to-get-at spots to hinder painting when it's needed. Reliability is improved because there are fewer places for leaks to develop.

LOWER NOISE LEVEL has resulted from improvements in core design and materials, and newly developed methods of annealing the core steel. Lower noise levels are a feature of all Wagner transformers.

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Taum Sauk Will Provide 350 Mw of Peaking Hydro

(*Continued from page 53*)

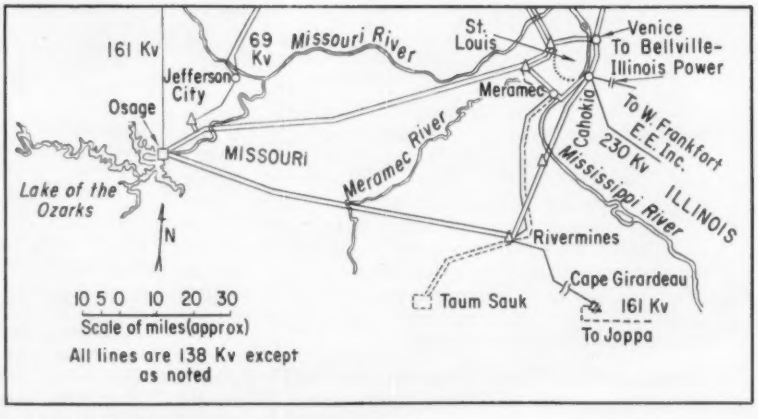
alternate indicated that the installation of Taum Sauk for 1963 service would be sound economically. However, estimated costs for pumped storage were higher than had originally been hoped. The margin in favor of Taum Sauk did not provide much incentive to undertake such a novel project. So, the question as to whether to proceed with Taum Sauk or new steam hinged rather critically on the estimated cost of the former. Our engineers were used to estimating steam plants and transmission lines. As this did not carry over to a hydroelectric plant such as Taum Sauk, considerable conservatism had properly been exercised in preparing the pumped-hydro estimate.

A sound decision, therefore, could not be made without taking firm bids to establish a fully realistic cost for this hydro alternate. Firm bids were requested and four were received from combines including ten leading construction firms. All bids were good, but at least two were sufficiently attractive to remove any doubt that it would be to the distinct economic advantage of Union Electric to proceed at once with Taum Sauk. Thus, on December 11, 1959, the contract was awarded to the successful bidder, Fruin-Colnon Contracting Co of St. Louis and Utah Construction & Mining Co of San Francisco, joint venturers.

A certificate of public convenience and necessity to construct Taum Sauk was obtained from the Missouri Public Service Commission in early 1960. In February 1960, the company filed a declaration of intention with the Federal Power Commission and in June 1960, at the suggestion of its staff, filed a license application. It is the company's belief that a license should not be required. The principal question at issue is the scope of that Commission's jurisdiction over projects on non-navigable streams. This matter is being pursued.

The dependability and flexibility of hydroelectric equipment, coupled with the ready availability of a large block of capacity when such units are floating or at standstill as reserve, combine to make this type of plant a very useful tool in system operation. Pumped storage expands greatly the possibility of using this type of equipment in such a role. The lean plant concept embodied in Taum Sauk opens up possibilities in areas in which conventional or combination hydroelectric installations are impracticable.

When geography and topography are near ideal, a long look should be taken before a "lean concept" pumped storage project is abandoned because of an apparent lack of water. This is especially true when heads in the 700 to 1,000 ft range are obtainable. At 800 ft



TRANSMISSION LINES to Taum Sauk must handle pumping load plus the present Rivermines Substation load. A significant part of Taum Sauk generation will be absorbed by Rivermines. Thus transmission facilities were determined mainly by the pumping requirements of Taum Sauk

head, a 350-Mw plant can be put into operation with the quantity of water delivered by a 12-in. diameter pipe flowing at 10 fps for one year. If only three or four square miles of drainage area are available, in many sections of the country there would be no make-up required for evaporation. In the most arid sections, with no drainage area, the constant flow at 10 fps of a 6-in. diameter pipe would be more than adequate to supply evaporation for this project. Wells should not be overlooked as a source of water. A sufficiently compact project could be made largely independent of geology and of leakage by paving of reservoir areas and complete tunnel lining.

Because many variables enter each picture, each possible project must be carefully analyzed in its own setting. Systems with a lesser proportion of plants best suited for peaking purposes than Union Electric could easily find a pumped storage installation even more attractive. Efficiency in a pump-turbine unit should be carefully weighed against first cost. Capital cost considerations are of prime importance in a peaking plant, and energy costs are secondary.

If a pure pumped-hydro plant is justified economically at the time of its installation, it will not only remain so throughout its life, but it will actually improve over the years. It will achieve its maximum value when it ultimately attains the status of pure reserve. In that role it will furnish a super grade of stand-by service with negligible manning and energy costs, as well as with low fixed charges.

Peace River Plans Change

Rumors that plans for construction of the huge Peace River project are to be abandoned have been labeled "fantastic" by W. C. Mainwaring, president of Peace River Power Development Corp.

However, PRPDC is considering modification of the first phase, depending on a British Columbia Energy Board report in August. The Board is conducting a study for the B.C. government intended to show power markets from joint development of Upper Columbia and also Peace project.

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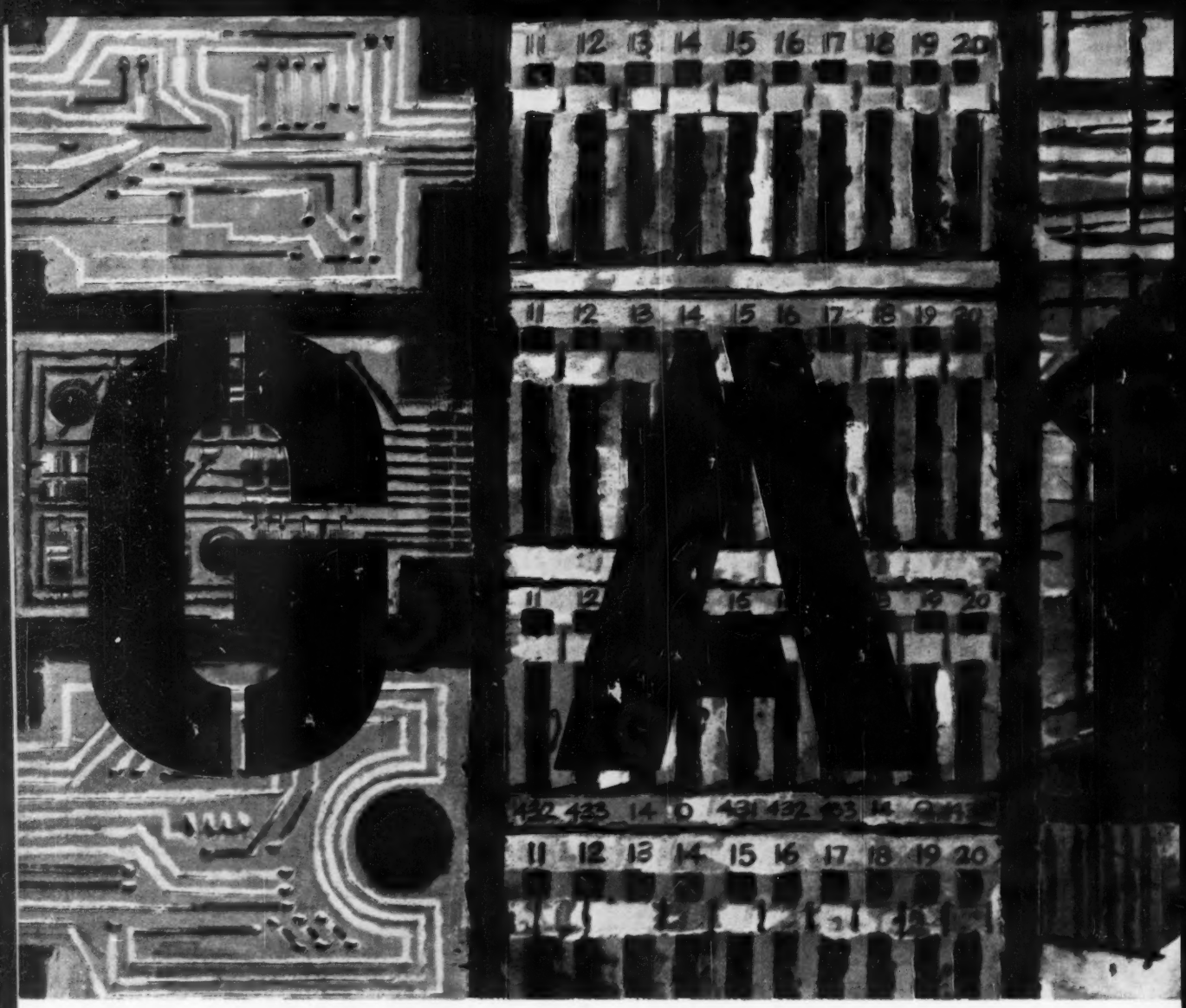
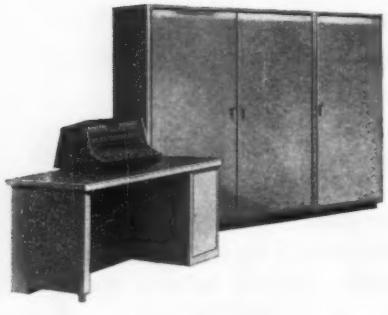


G Gathers automatically the information the operator needs to supervise the plant.

A Alarms off-limit quantities... automatically warns when an unsafe value occurs and logs all points exceeding pre-set limits.



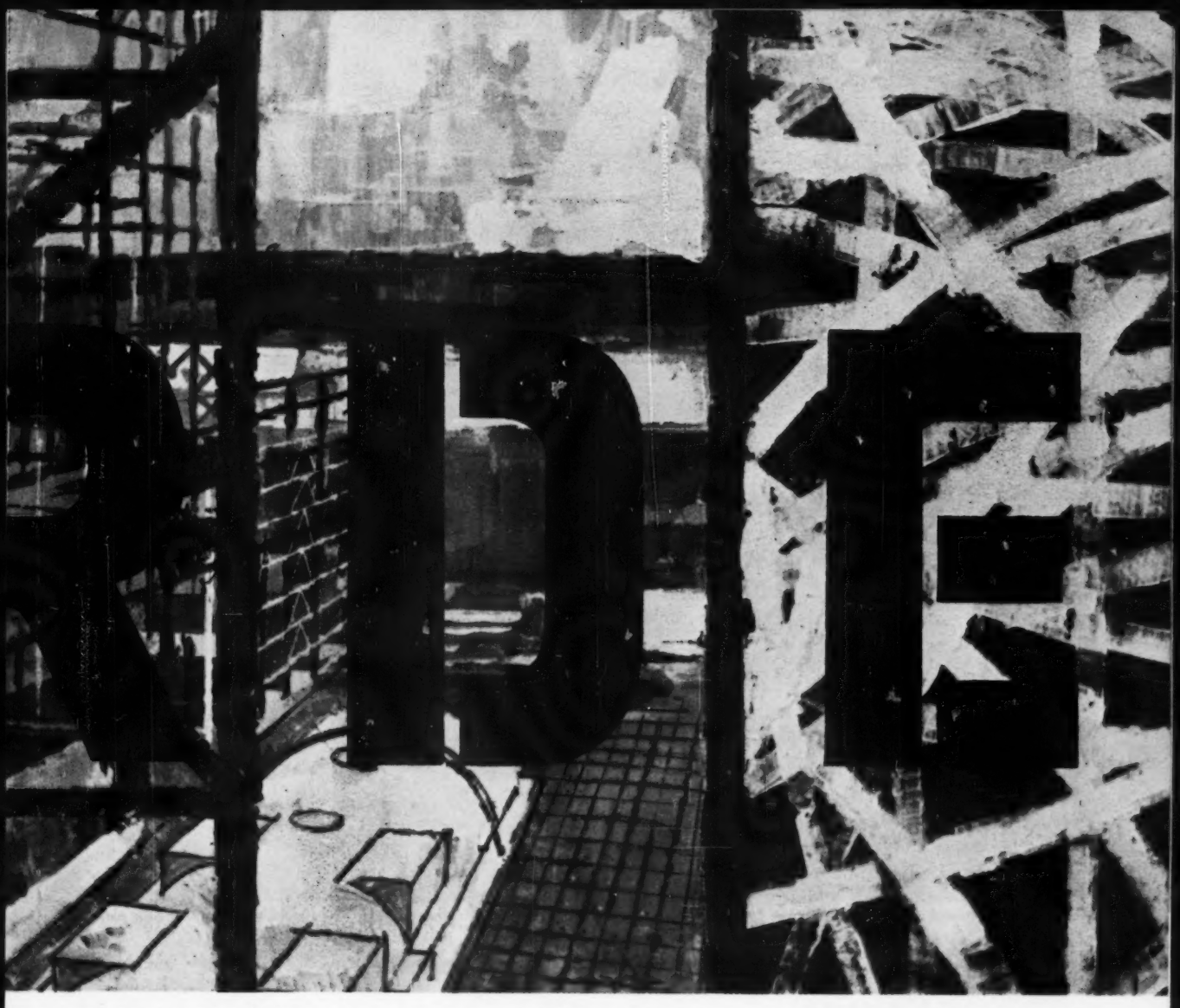
NEW GENERAL ELECTRIC COMPUTER SYSTEM

designed solely for electric utility steam power plant data processing

HERE'S HOW GENERAL ELECTRIC'S ADVANCED DESIGN SYSTEM LOWERS OPERATING AND MAINTENANCE COSTS...

GARDE is General Electric's process computer system designed especially to meet the problems and needs of electric steam plant data processing. The GARDE system gathers, alarms, reports, displays, and evaluates data from several

PCA-1



R Reports... automatically prepares a complete log of all operating conditions hourly or on demand.

D Displays... continuous visual display of any input or computed value that the operator chooses.

E Evaluates... over-all plant and key component performance hourly—or on demand.

hundred inputs located throughout the plant. It warns of abnormal deviations in those process conditions which cause equipment stress and inefficient operation. Early detection of these saves dollars in equipment maintenance and increases operating efficiency.

In addition, the GARDE system checks itself—detecting faulty sensors and other components. Its continuous reports are invaluable in periods of rapid operational changes. One of its provisions guides the operator through complex plant operating routines, helping him avoid errors and resultant equipment outage.

GARDE system evaluates these key plant operations: Boiler efficiency • Turbine Generator Heat Rate • Station Heat Rate • Correction of Heat Rates to Bogey Conditions • High Pressure and Intermediate Pressure Turbine Efficiency • Feedwater Heater and other Equipment Performance • Condenser Performance.

General Electric was able to design the GARDE system because it leads all manufacturers in process computer systems installed or ordered by the utility industry. The near-million man-hours of application and research in its design were spent in implementing systems for users. Out of this experience, came the GARDE process computer system.

.....

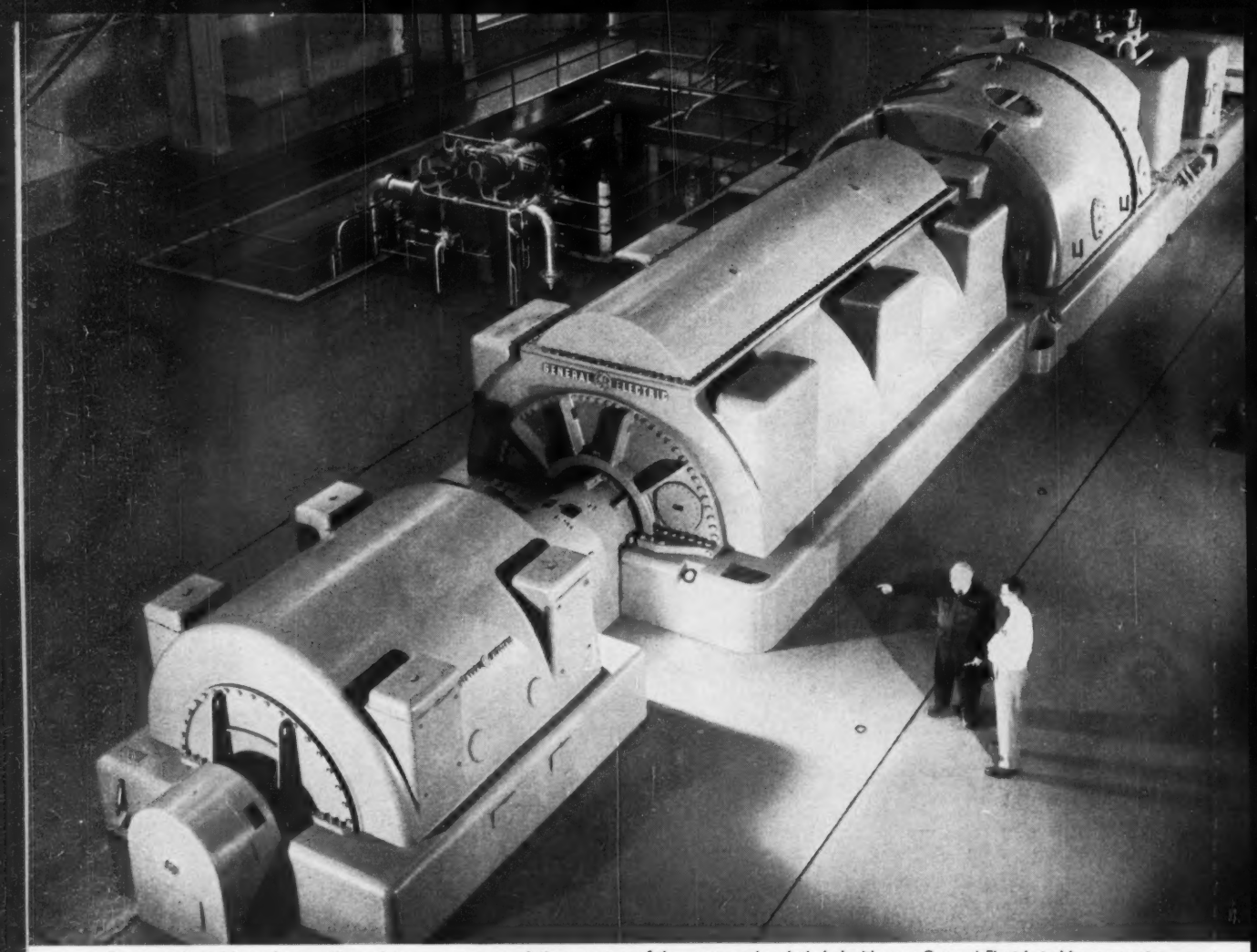
Investigate this newest development in data processing for steam plants—contact your nearest General Electric Apparatus Sales Office or Process Computer Section, Industry Control Department, P. O. Box 2918, Phoenix, Arizona.

In Canada, contact Canadian General Electric Apparatus Sales Department, Peterborough, Ontario.

Outside the U.S. and Canada, contact International General Electric, 150 East 42nd Street, New York 17, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Frequent plant visits and preventive maintenance recommendations are two of the many services included with your General Electric turbine-generator.

Service . . . an integral part of your General Electric turbine-generator

For as long as your General Electric turbine-generator is on the line, members of your G-E turbine-generator service team . . . who have followed your unit from the time you placed the order, through design, manufacturing, installation, and start-up . . . frequently visit your power plant.

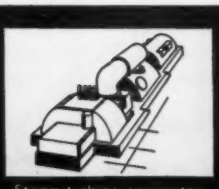
During these inspection visits, they check the unit and evaluate its performance with you and your operating, maintenance, and engineering personnel. They recommend planned preventive maintenance based on your most convenient down-time. Then they assist you in getting your unit back on the line in the shortest time possible.

In addition, your G-E service team makes recommendations . . . based on the findings of General Electric's continuing design analysis program . . . to improve your unit's performance. They do all this . . . for as long as your turbine-generator is on the line. 244-06

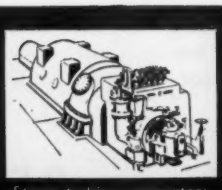
Progress Is Our Most Important Product

GENERAL ELECTRIC

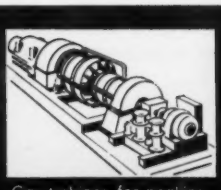
General Electric Turbine-Generators Help Keep Power Costs Low



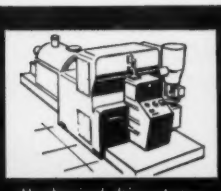
Steam turbine-generators for large blocks of power



Steam turbine-generators 100,000 kw and lower



Gas turbines for peaking, base load, combined cycles



Mechanical drive steam turbines for auxiliaries

Electrical World

MAY 8, 1961

Management Newsletter

Is Some of Your Income Missing?

Many electric utilities are losing income. It's not that they're forgetting to collect payment on their bills, or that they're ignoring phantom customers who are connected into street lights. But the dollars that are slipping away are just as real as those that would be lost by providing non-cost service. And they're relatively easy to collect.

How do utilities let income slip through their fingers? By not taking advantage of several tried and true accounting methods. These are:

- *Full* interest during construction credits.
- Capitalization of taxes during construction.
- Capitalization of pension plan expense.
- Capitalization of financial officers' salaries.
- Tax deduction for capitalized salaries.
- Prepayment of equipment contracts.

Willard F. Stanley, former financial executive with an electric utility, and presently financial consultant and author, says all these techniques have been used effectively at one time or another in the electric utility industry. But since their use wouldn't appear in annual reports or in the statistical tabulations prepared for the security analysts, he doesn't know how extensively they're used at present. Stanley doubts, however, that electric power companies are getting all the benefits which the techniques can provide. Here's what he suggests:

TAKE FULL INTEREST DURING CONSTRUCTION

Most electric utilities credit their income accounts with interest during construction. This credit represents the financing cost of the funds which the company must commit to pay for construction projects which won't bring a return until the project is actually on the line. Goodbody & Co looked over the utility spectrum in 1960 and found that at least 112 utilities were taking such credits. But Stanley points out that many companies take these credits only on relatively large items where the amounts of interest accumulated during the construction period will justify the bookkeeping involved. Utilities should also take credits for smaller items, such as meters, transformers, etc., held in inventory for subsequent inclusion in construction projects. Companies can simply use the rate generally taken for interest during construction, and apply it to the amounts of this small equipment held in inventory at the end of each month. Stanley estimates that for a utility with $400 million in net assets, this technique would add $30,000 a year to income.

Once you have the income, what do you do with it? Two alternatives are open. First, you can treat it as taxable income, and add it to the cost of the project. This gives you a bigger piece of property to write off, and reduces income (and therefore taxes) for the life of the property. It also adds to the rate base. The second treatment, which Stanley prefers, is to exclude the credit from taxable income. True, it cannot then be added to the cost of construction, but it does give the company the use of interest-free funds (really deferred taxes). These funds are, however, available over only half the life expectancy of the project. This is so because if the credit had been added to the construction cost, the utility would recover its value when it finished writing off the construction. So, at the end of the project's useful life, the advantage of taking the full credit at the beginning (rather than adding it to construction cost) would be zero. This makes the average advantage of taking credit all at once only half its face value, or, to put it another way, it gives the utility interest-free use of the funds over half the life of the project.

What does this mean? Here's an example. A $30,000 credit, assuming a 50% tax rate, would be equivalent to the free use of $15,000 for a period of 18 years on a project with a 36-year life-expectancy. If we accept an over-all cost of money to the company of 6%, the gain would be in the neighborhood of $45,000. If a company had added the credit to construction cost instead of taking it as non-taxable income, it would be many years before the additional book charges created would approach the amount of the original credit. And treating the credit as part of the construction cost would never give the utility the full $45,000 value that it would receive by treating it as non-taxable income.

CAPITALIZE TAXES DURING CONSTRUCTION

Many jurisdictions tax property on which construction is taking place. These taxes are quite fairly considered to be a cost of construction, and can total up to significant amounts. Let's assume a utility with $400 million of net assets has a growth rate of 6% a year. Annual construction would then come to $24 million. It seems reasonable to expect an average of $6 million of new construction to be carried on the books at the assessment date for taxes, and if we assume a 2.5% tax rate, the taxes on this construction would reach $150,000 a year.

A utility can consider this amount simply as an operating cost which reduces income before taxes by $150,000. With a 50% federal tax base, the reduction in income after taxes would be $75,000. But there's another course of action which Stanley finds more sensible. Capitalize these taxes, he says. By capitalizing taxes, a utility increases its property base both for book and income tax purposes. This means that during the life of the project which was constructed, income is reduced by the amount of depreciation applied to the capitalized taxes, less the amount of income tax saved by the additional depreciation deduction.

Certainly, it will be many years before these net reductions in income catch up with the large reduction in income that would have occurred if the utility had taken these taxes during construction as an operating expense. By not capitalizing taxes during construction, utilities are letting income slip through their fingers.

CAPITALIZE PENSION PLAN EXPENSE

Today, just about every utility has a pension plan for its employees. And the Uniform System of Accounts of the FPC allows this expense to be capitalized just as interest during construction is capitalized. This means that a company can increase its income by carrying over to its plant account that portion of its pension expense which covers the time workers spend on construction projects. Let's go back to our utility with $400-million net assets.

Such a company could have $100-million annual operating revenues with 20%, or about $20 million payable in annual wages. $3 million of this might apply to wages related to construction matters. Let's stretch the assumption a bit further and assume that company contributions to the pension plan equal 5% of the wages (conservative in this age of fringe benefits). In this case, pension plan contributions related to construction activities come to $150,000 annually.

The situation is now the same as that faced with taxes during construction. The company can either take this cost as an operating cost and reduce its income by $75,000 after taxes, or it can capitalize the amount and write it off slowly during the life of the project. The net income deductions from the write off would be a long time in approaching the single blow to income from considering such pension expense as an operating cost.

Of course, both taxes and pension expense capitalized add to the rate base, and after the first commission rate award, begin earning a 6% return for the company. This is a further incentive to capitalize.

CAPITALIZE FINANCIAL OFFICERS' SALARIES

Most utilities have a constant expansion pattern, and put a considerable portion of executive officers' time into financing this new construction. This expense can be simply an operating expense like any other salary which the company pays. But there is an alternative. And while the Uniform System of Accounts of the FPC doesn't specifically provide for this alternate, it does not forbid it. Furthermore, wherever the alternate treatment has been used, it has won approval from independent auditors. Here's what it looks like.

Time spent in financing can be divided into two categories. First is time devoted to issuance of funded debt securities. Second is time spent in issuing preferred or common stock. In the first case, Stanley recommends that executive salary paid for time spent in issuing debt securities be charged to Unamortized Debt Expense under "Deferred Debits." In the second case, time devoted to equity financing should be charged to Capital Stock Expense.

Such salary charged to unamortized debt will be written off through equal annual charges to income over the life of the funded debt involved. These charges are, of course, deductible for income tax purposes reducing the net deduction from income, and this deduction would be far less than the deduction caused by taking the salaries as operating expense. Salaries included in Capital Stock Expense need never be written off. But let's suppose the company elects to eliminate them. It then writes the salaries off by direct charges to surplus which in no way effects the income account. Stanley estimates that for our $400-million electric utility, the increase to income would be $20,000. And this increase would occur each year as long as the rate of expansion continues.

TAKE TAX DEDUCTIONS FOR CAPITALIZED SALARIES

Electric utilities have for many years followed the practice of capitalizing as part of the cost of property additions the time spent by officers and employees in connection with construction matters. This is, of course, permitted by both the FPC and the state utility commissions. But utilities don't have to stop there. It appears from court cases that even though a portion of such salaries is capitalized in the company books, the entire salary is deductible for income tax purposes. This is true when the utility can reasonably show that the men would have been employed at their current compensation even if the company were not constantly engaged in construction.

To take full advantage of this situation, Stanley recommends that utilities treat salary attributable to construction in two different ways. In their books, they should capitalize the portion of salary involved and write it off over the life of the project. The reasons for this have already been given. But when it comes to paying taxes, the full amount of salary should be taken as an operating expense.

Salary taken as an operating expense in paying taxes increases income to the extent of half (again assuming a 50% tax rate) the amount of such salaries capitalized in the books. It also provides the utility with interest-free funds for half the life of the project. This is so because if the utility had elected to capitalize the portion of salary connected with construction, it would have recovered the same tax deduction when it completed writing-off the project. If we assume an average borrowing cost of 6%, then a $30,000 reduction in taxes is really worth about $45,000 to the company.

PREPAY EQUIPMENT CONTRACTS

Stanley's final suggestion concerns the purchase of equipment. When major equipment, such as turbines, are purchased, the cost involved can come to several million dollars. Usually, the utility agrees to pay the manufacturer over a period of time. But if the utility can pay for the equipment ahead of the scheduled dates, manufacturers will grant a reduction in price. This reduction will equal the amount of money the manufacturer can earn on the prepayment from the time of actual payment to the date of scheduled payment.

The principal increase in income from this technique arises from the larger investment in the project at an earlier date. This increases the amount of interest during construction which is capitalized and credited to income. The net increase to income would be the difference between the increased interest during construction, and the cost of borrowing the funds in order to make the prepayment. Manufacturers would probably grant a reduction equivalent to what they could earn with the prepayment on 90-day treasury bills. So, the utility couldn't use this technique effectively unless half the rate of interest on the money it borrows (assuming 50% tax rate) is less than the yield on 90-day treasury bills.

Additions to income from each of these methods are small. But let's look back at the hypothetical utility we imagined in the beginning, the company with net assets of $400 million. As we follow this company through each technique which Stanley has suggested, the small savings begin to mount up. By the time our imaginary utility has ventured into all six techniques, the increase to income is in the vicinity of $260,000. This certainly won't push a utility into the ranks of America's giant corporations, but it's a little too much to overlook.

What would this do for the stock's market value? Let's assume an average price earnings ratio of 18-1. The $260,000 now becomes about $4.5 million in market value. Again, this amount won't skyrocket the company's prestige. But still, it's nothing to sneeze at.

cut costs with service-proved GC breakers

When the new Westinghouse GC Single Tank Three Phase Power Circuit Breakers (rated 14.4 kv; 100, 250 and 500 mva) were first introduced, tests indicated that they would provide greater protection and require less maintenance and installation cost than the superceded type G breakers. Actual service records now verify these predictions.

Three key features make this performance possible.

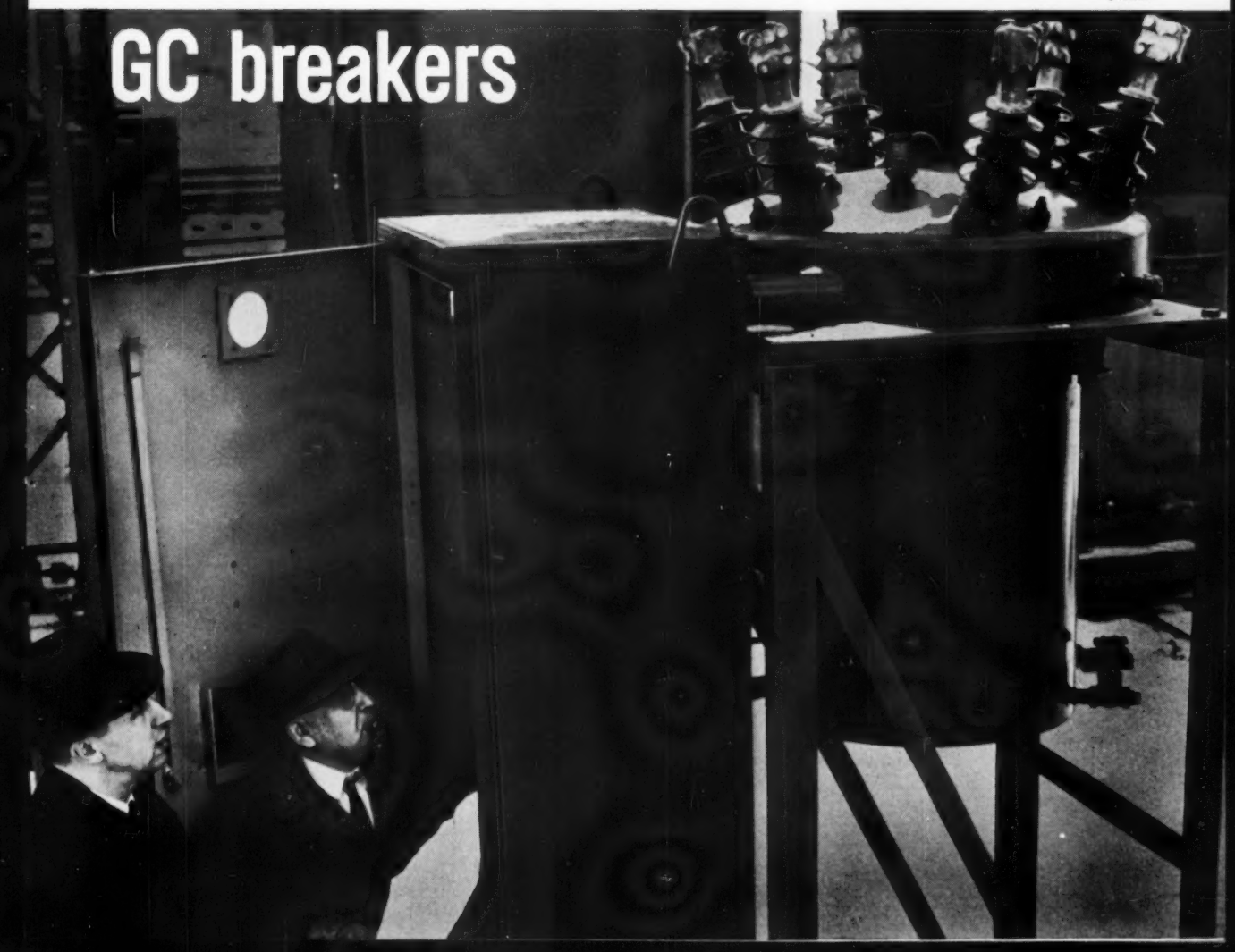
First, these GC breakers interrupt essentially within three cycles, from 0 to 100% of rating. This provides greater protection against line and equipment damage due to faults—reduces possibility of line burndown. It also reduces arcing time within the breaker which results in less contact burning and oil contamination and, therefore, less maintenance.

Second, simple solenoid operating mechanism minimizes maintenance.

Third, closing current requirements have been slashed to less than one-half compared to units available as recently as three years ago. Result here is lower installation costs since much smaller control cables and transformers or batteries can be used.

For complete facts, call your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's*

Westinghouse

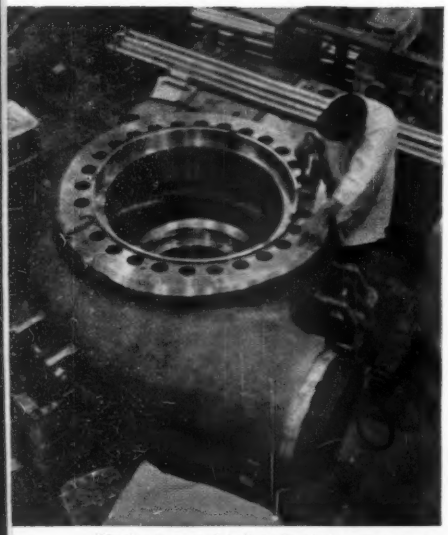


J. M. Kadetsky (right) of Pennsylvania Electric Company and T. C. Pitzer, Westinghouse Sales Engineer, discuss a 14.4 kv, 100 mva, GC Breaker. A good performance record has been logged by this unit installed in Pennsylvania Electric's Boulevard Substation, Johnstown, Pa.

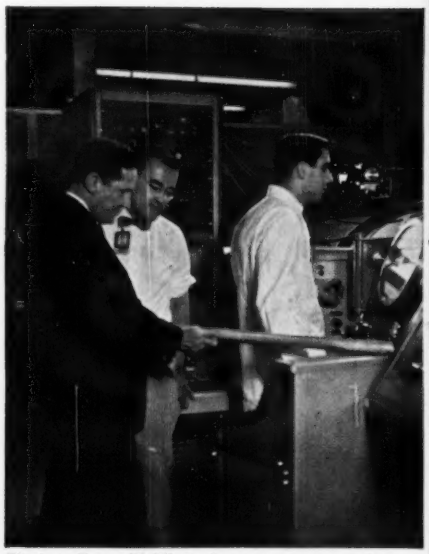
J-61012

Thousands of Westinghouse people work full time on commercial atomic power

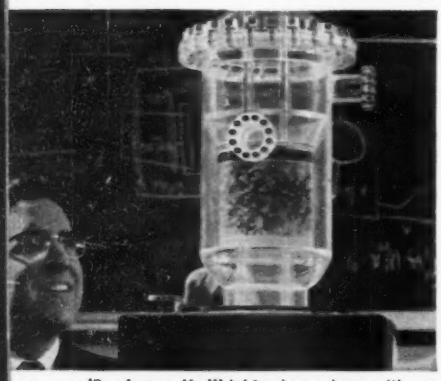
People, facilities and successful experience . . . these are reasons why Westinghouse is the world's leading supplier of nuclear power plants and components.



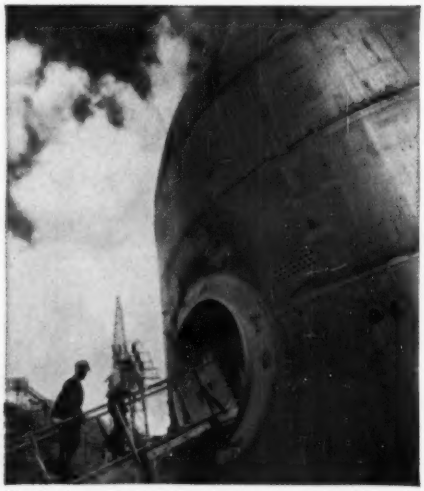
Westinghouse Quality Control inspector is working on a nine ton stainless steel pump casing at the Atomic Equipment Department in Cheswick, Pa. Department produces canned motor pumps, valves and control rod mechanisms.



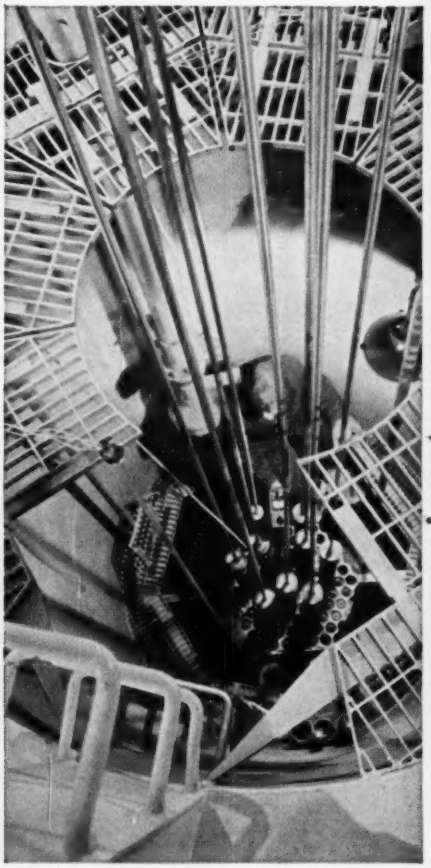
Electron Beam Welding of core components is one of the many special skills employed at the Atomic Fuel Department, Cheswick, Pa. Standard products of the department are reactor cores and their components.



Dr. James H. Wright, shown here with an organic moderated fluidized bed reactor model, is also doing important development work on the concept of an integral boiling and superheat reactor (IBSHR).



Westinghouse Engineers, after design, follow through on construction of reactor plants such as this 5,000 kilowatt plant being built at Saxton, Pa., for the Saxton Experimental Corporation. This new reactor will be used with an existing turbine generator at the Pennsylvania Electric Company site.



Critical Experiment Station at Testing Reactor. This technician is working in the low power test facility used to confirm physics calculations by experiments before exposure in the reactor.

Westinghouse Testing Reactor facility includes hot cells and metallographic cells for post-irradiation examination of samples. Nuclear fuels and other materials can be tested inside cylindrical fuel elements of reactor core. Chemical, analytical and counting laboratories are used for post-irradiation tests.

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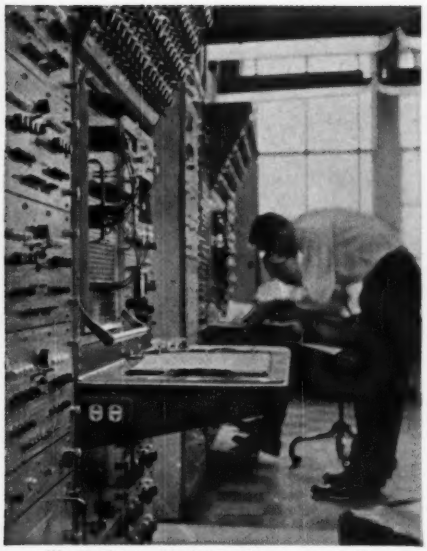
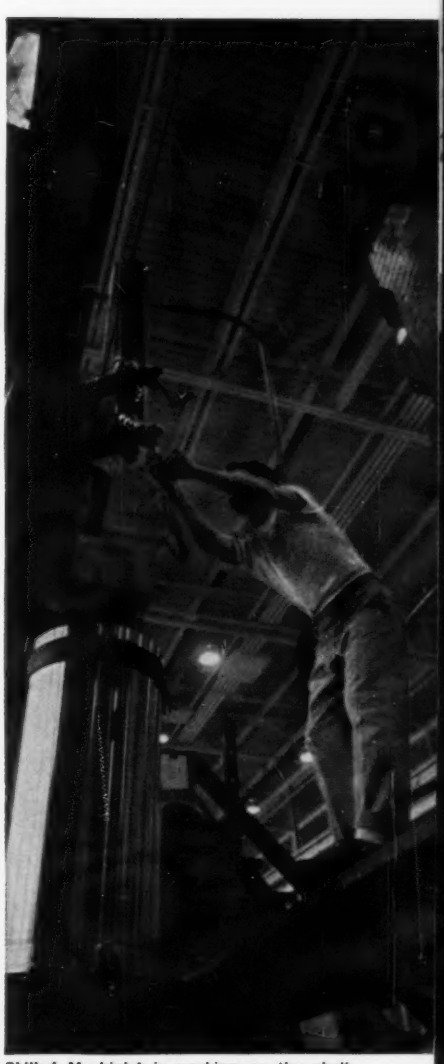


Westinghouse Mathematicians are working out the solution to a nuclear fuel problem at this computer installation in the Atomic Power Department at Forest Hills, Pa.

Dr. W. E. Shoupp, Technical Director of the Atomic Power Department, plays vital role in developing atomic fueled plants to the point where they will be economically competitive with fossil fueled plants in the generation of electric power.



Skilled Machinist is working on the shell and flange for a canned motor pump on a 120" vertical boring mill at the Atomic Equipment Department.

Dr. Joseph C. Danko heads up promising advanced research of the thermoelectric reactor, a potential means of generating electricity directly from fission heat without a turbine-generator unit.

Fuel Assembly Operation at the Atomic Power Department, where facilities are maintained for development of advanced fuel concepts. Technician is working on cage of a fuel assembly.

Dr. Sidney Krasik, Technical Director of Astronuclear Laboratory, works on applications of atomic power in outer space, such as nuclear power propulsion, the nuclear ram jet and auxiliary power plants for space vehicles.

Westinghouse

New 15 kv
G&W Oil-Fuse Cutouts
are full-rated for 110 kv BIL duty!

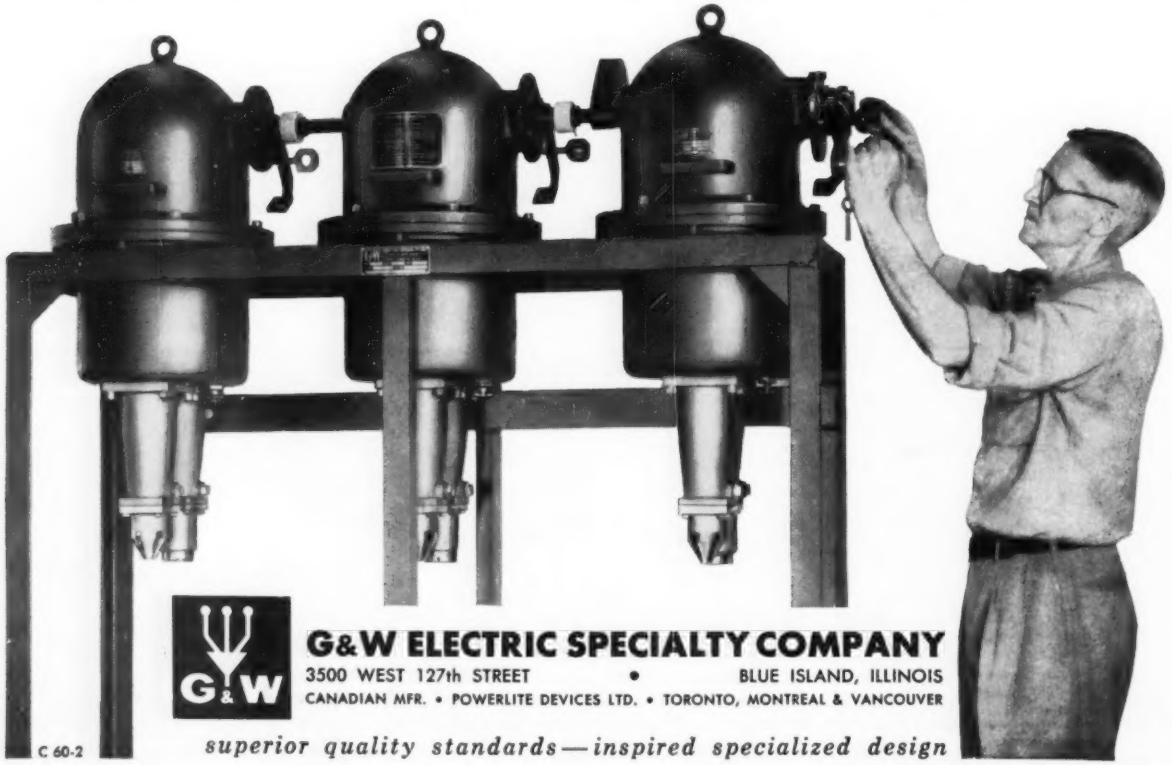
G&W Type FC72, 15 kv Oil-Fuse Cutouts have full 110 kv BIL and high interrupting ability for today's distribution circuits. Impulse withstand level is 110 kv under standard 1½ x 40 microsecond wave and 60-cycle one-minute withstand is 50 kv.

The Type FC72 Cutout can interrupt 7000 amperes asymmetrical (4200 amperes symmetrical) on single-phase operation at 13.8 kv, or 100,000 kva, symmetrical, on three-phase applications. Continuous-current rating is 200 amperes. It can break load currents up to 300 amperes where power factors are 50% or higher and can break magnetizing and load currents of 100 amperes at power factors of 20% or less. Metal-to-metal flanged surfaces with retained gaskets and a heavy wall dome area make this device applicable for use in hazardous locations.

The new G&W 15 kv Cutout is safe, simple to install, easy to operate, and requires little maintenance. In-line construction with operating shaft running horizontally through the cutout dome makes possible coupling of gang-operated cutout shafts in a straight line. Operating handle rotates beyond dead center to lock both "On" and "Off" positions. The interrupter unit with fuses and replaceable switch contacts is raised into the dome above the oil when the cutout is switched to the "Off" position. They are accessible when dome is swung back on its hinge. Dome cannot be opened while switch is in the "On" position.

Repeated tests of the G&W Type FC72 Oil-Fuse Cutout show it will operate five times at full interrupting rating before inspection or replacement of oil is needed.

Contact your G&W representative for complete information, or send for Catalog CC.



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G&W ELECTRIC SPECIALTY COMPANY

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CANADIAN MFR. • POWERLITE DEVICES LTD. • TORONTO, MONTREAL & VANCOUVER

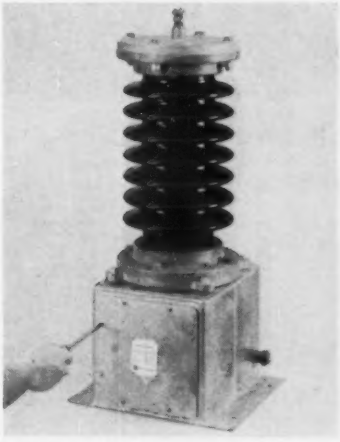
superior quality standards—inspired specialized design

Line Post Insulators . . .

. . . available in five ASA sizes from 23 kv through 69 kv, feature an extra-wide 1¾-in. wire groove to accommodate large conductors. Grooves have circular depths ranging from ⅝-in. in the lowest rating to ¾-in. in all other ratings. The new insulators have a rated cantilever strength of 2,800 lb, and a substantially higher impact strength. Units tested at twice their cantilever rating produced no breakage in the porcelain. The insulators feature an exclusive metal disc which makes the insulator seal air tight to prevent moisture from entering the porcelain column. This also eliminates the conventional rubber diaphragms which tend to wrinkle and deteriorate causing damage through air leakage. Long or short-line post studs for steel or wood cross-arm mounting are available in each rating.
General Electric Co, Schenectady 5, N.Y.

Potential Device . . .

. . . monitors voltages in the 23 to 161-kv ranges to replace conventional potential transformers. The device is a high-voltage, oil-immersed resistor providing up to 3.5 ma as a direct function of line-to-ground voltage, is immune to reactive effects, has no frequency sensitivity, damps voltage surges, and can remain connected during impulse and low-frequency withstand tests. Designed for outdoor service on 23 through 161-kv service; for indoor service on 23 and 34.5-kv systems. Impulse levels (BIL) range from 150 kv for the 23-kv models to 750 kv for the 161-kv models.
S&C Electric Co, Chicago 40, Ill.



LV Transformer Bushings . . .

. . . for 69-kv to 15-kv service complement the Breaker-Tran line by covering the common dimensional requirements for transformer bushings included in Table 3, ASA standard C76.1a-1958. The Class GK bushing line is full-condenser type with oil-paper construction. In each voltage class the 400-amp, 16½-in.-oil-level and the 400-amp, 21½-in.-oil-level transformer bushings employ tubular conductors, draw-lead terminals and no stud below the end cap. The 1,200-amp, 21-in.-oil-level transformer bushing employs a solid conductor which extends below the lower-end cap and above the oil reservoir.
Ohio Brass Co, Mansfield, Ohio

(More New Equipment on page 82)

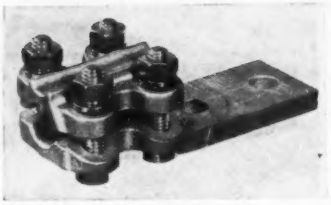
don't jump

at the first chance when you buy distribution transformers . . . wait until you've heard about the really new

LL-65

coming soon from Westinghouse

J-70963-3



Terminal Lugs . . .

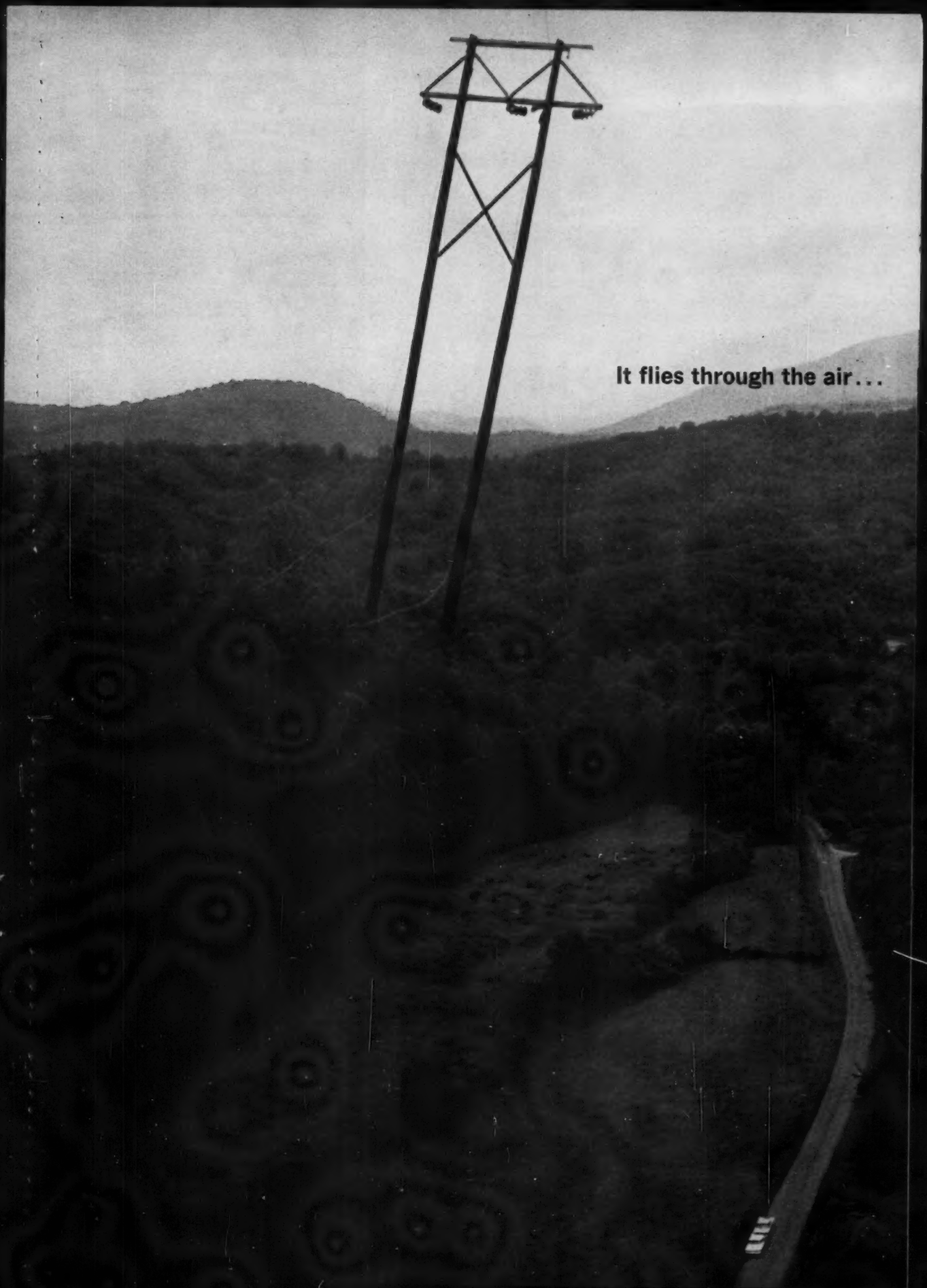
. . . **feature reversible caps** of high-strength bronze which require the use of only five lugs to cover application of any cable size from No. 8 solid through 2 million stranded copper. With RAR lug series a total of only three connectors may be selected to cover full cable range to which this line applies, yet good cable enclosure for any specific conductor is retained. High-conductivity body and four-bolt clamping provide heavy-duty, all-purpose terminal for almost any cable to flat application. Also, there is a choice of one, two, or four-hole NEMA tongues, plus additional selection of straight, 45-deg, or 90-deg angle tongue. **Penn-Union Electric Corp, Erie, Pa.**

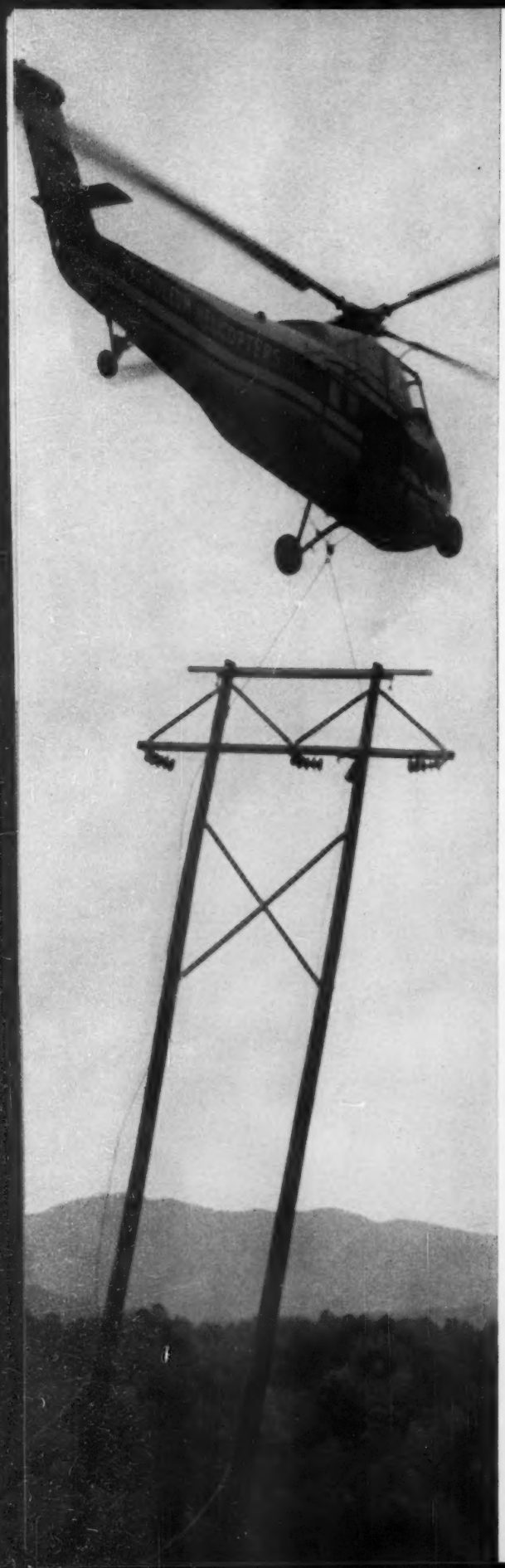
Portable Lamp . . .

. . . **has high and low beam** and projects light over 2,000 ft when the main bulb is used. Made for utility service, Big Beam Power House has 7½-v dry-cell, clamp-on battery which is lightweight. Mounting plate completely overlaps battery top and protects terminals from dirt, moisture and hard knocks. Either removable bulb or seal beam-model provides beam with range and illumination for every purpose. All models are offered in gray Hammerloid baked-on finish or chrome plate.
U-C-Lite Mfg Co, Chicago, Ill.

Selling

Heat pumps will be installed in a 50-home project in Stamford, Conn.; more than half of homes were sold by the time the model house was opened on April 15. . . **Nearly 60,000** electric ranges, the largest in the history of the utility, are now on the lines of Western Massachusetts Electric Co. This compares to 28,170 in 1950. Eight out of ten ranges being installed are going into new homes, while nearly 50% of the company's residential customers have electric ranges. Other electric appliances showing increases in the past ten years are: Water heaters, 15,328 as against 2,712 in 1950; dryers, 16,574 compared to 952; and food freezers, 20,934 as against 3,822. . . **Fifteen new industries** representing a capital investment of $1,558,000 have located on Georgia Power Co lines in the first quarter of 1961. In addition, eight existing industries constructed new facilities to expand their operations, representing an investment of $4,870,000. . . **Gas industry** forecasts sizable inroads into air conditioning field. W. G. Wepfer, general sales manager of Arkla Air Conditioning Co, predicted that gas should be able to compete for about 80% of the total central-system market within a year or so, compared with 20% last year. Sales objective for 1961 is to increase sales by 70% over 1960, or 25,000 units compared to 15,000 sold last year. . . **Television advertising** by public utilities climbed from $9.8 million in 1958 to $12.3 million in 1960, according to Television Bureau of Advertising. A total of 164 utilities used various television campaigns; 91 used spot announcements; 46, program campaigns; and 27 had combined announcements and campaigns. The 46 programs divided into news, weather, films, documentaries, sports, food and cooking shows, and home building programs. . . **More than 175,000 prospective** buyers have flocked to Electric City, N. J., since it was opened March 15, and 200 homes have been sold. Electric City is reportedly the largest total-electric community of its type, with some 1,100 homes scheduled to be constructed.


It flies through the air...



Setting H-frames in pre-dug holes along right-of-way, helicopter acts as an airborne crane.

at the lowest of costs

American Electric Power Demonstrates New Helicopter Construction Methods... Cuts Construction Time to One-Third

In a history-making experiment in power line construction, American Electric Power Company put a Sikorsky helicopter to work in virtually all phases of power line construction with results that point to a prominent new role for helicopters in the near future.

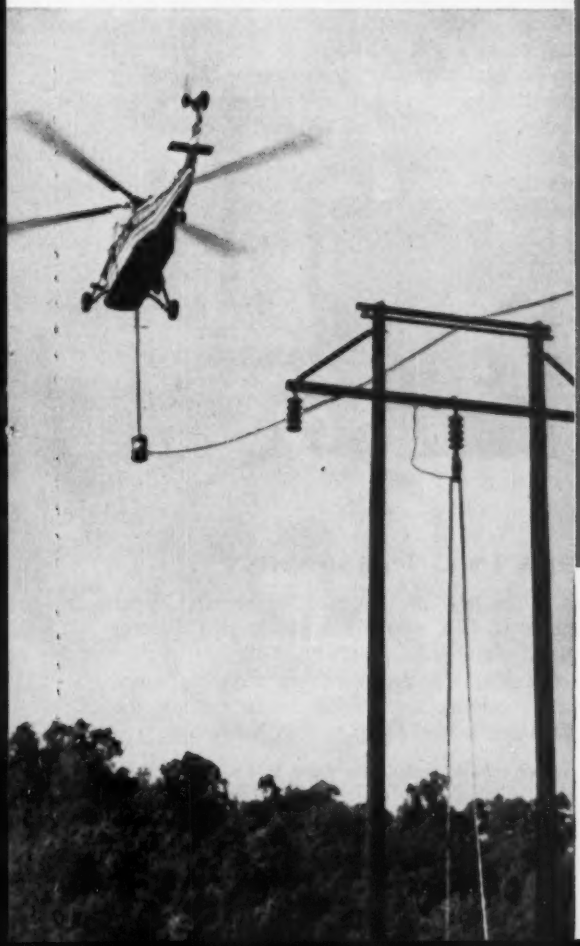
For the first time, a construction project was planned from the start to take advantage of the helicopter's unique abilities . . . as a go-anywhere truck . . . as a flying crane . . . and as a high speed cable stringer. During the course of the six-week operation, the helicopter chalked up records like these:

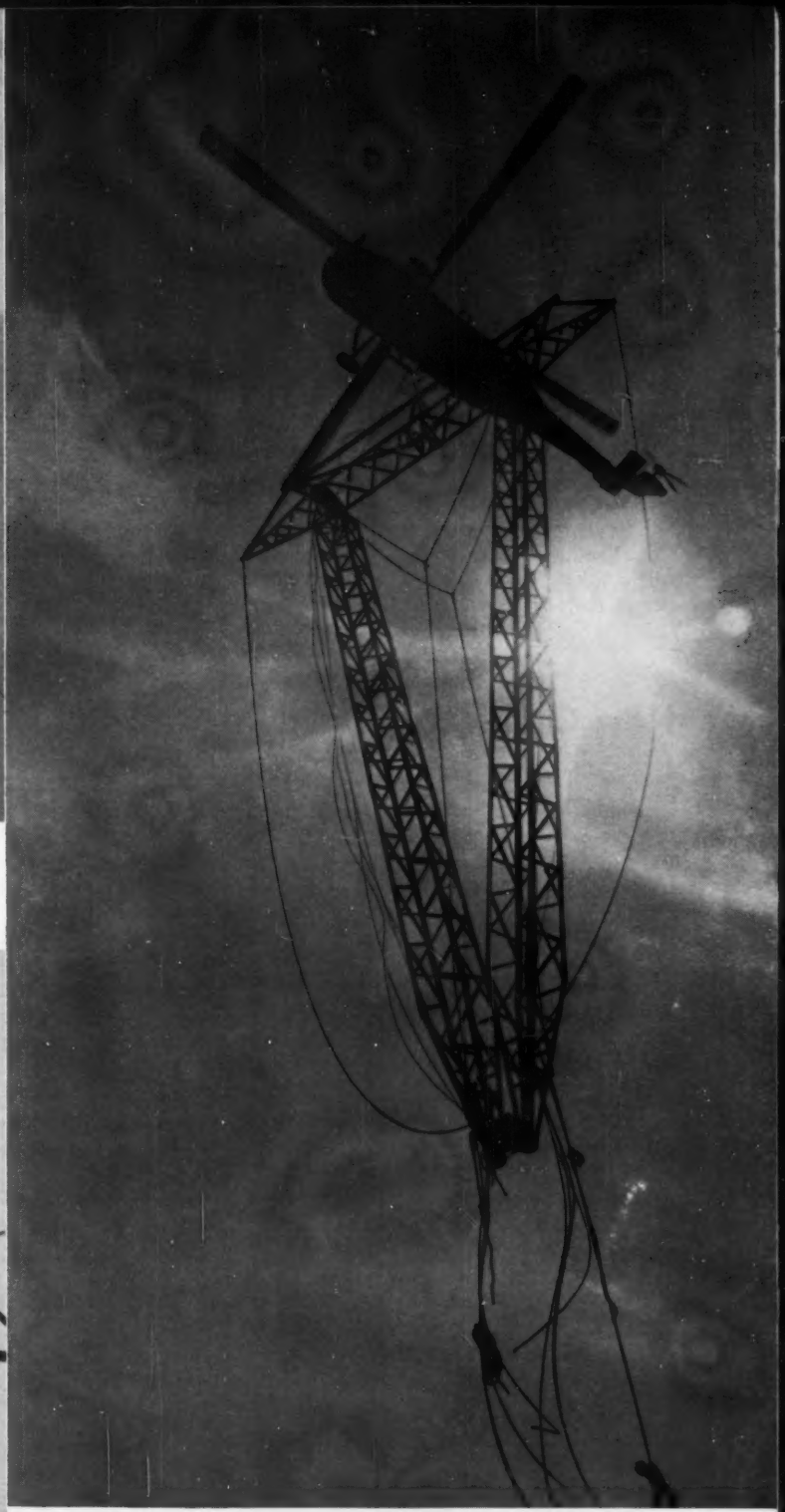
On its first morning in operation, it transported all the steel for 4.5 miles of right-of-way—a total of 268,000 pounds of steel for 17 towers—from staging areas to tower sites in just 4½ flying hours. Conventional methods would have taken three weeks. In erecting steel towers, the helicopter demonstrated it could help crews raise two 60-foot side panels in an average of 14 minutes—normally 30 man-hours of work. Used as a flying cable stringer, the helicopter strung 121,000 feet of winch cable in just 4½ hours.

In total, the operation was cut to one-third the time it would have taken using ordinary methods. Two lines, totaling 29 miles, were constructed. Helicopter and pilot services were furnished to Appalachian Power Co., A.E.P.'s subsidiary, by Petroleum Helicopters, Inc.

As a result of the helicopter's outstanding success in this project, the Sikorsky S-58 is expected to play an important part in the construction of several 345KV lines now being planned.

(above) Erecting assembled panels is another flying crane operation. Panels go up in as little as two minutes. (below) Cable stringing: helicopter unspooled 9,600 feet per flight. In a typical 4½-hour period, 121,000 feet were strung.





A look at the future. In the first demonstration of its kind, a completely assembled tower is flown to site and bolted to footings. Entire operation from staging area to final bolt took just 10 minutes. Assembled with guys, experimental aluminum V tower for 138KV line weighed 2,900 pounds.

SIKORSKY AIRCRAFT Stratford, Connecticut
Division of UNITED AIRCRAFT CORPORATION

News About People

Duke Power Appoints Chairman

Thomas L. Perkins has been elected chairman of Duke Power Co. He succeeds George G. Allen who died last October.

Perkins resigned as chairman of American Cyanamid Co, a position he has held for the last three years. He will continue as a director of Cyanamid and a member of the company's executive committee.

A senior partner in the New York law firm of Perkins, Daniels, McCormack & Collins, Perkins is also trustees chairman of The Duke Endowment, private philanthropic foundation which holds controlling interest of more than 57% of Duke Power shares.

Perkins has been a director of Duke Power and a member of its finance committee since 1955.

New Chairman, President Named at Iowa Southern Utilities

MANN GREENLEAF

H. L. Mann has succeeded Edward L. Shutts as chairman and chief executive officer of Iowa Southern Utilities Co, while R. W. Greenleaf has been elected president. Shutts became honorary chairman.

Mann, a 45-year utility veteran, started with Burlington Railway & Light Co. He was with that company when its properties were acquired by Iowa Southern in 1925. He moved up through the ranks of Iowa Southern and became executive vice president in 1949 and a director in 1950. He has been president since 1956.

Greenleaf joined Iowa Southern as a vice president in 1952. He had previously served the company as legal counsel. He became a director in 1954, and later was named executive vice president and treasurer.

LILCO Makes Grogan Vice President

Long Island Lighting Co has boosted Russell M. Grogan to vice president in charge of the office of production, transmission, and construction.

Fred C. Eggerstedt Jr, vice president-finance, became treasurer and Charles R. Pierce was named assistant secretary as the company announced new records in revenue, income, earnings per share, customers, plant expansion, and area development.

◀ GROGAN

MILLIKEN ▶

Milliken Steps Into Presidency

Frank R. Milliken is the new president of Kennecott Copper Corp, succeeding Charles R. Cox who will continue as a director and executive committee member.

Milliken has been executive vice president and a director since 1958. Cox has been president since 1950 when he left the presidency of Carnegie-Illinois Steel Corp to join Kennecott.

(*More News About People on page* 90)

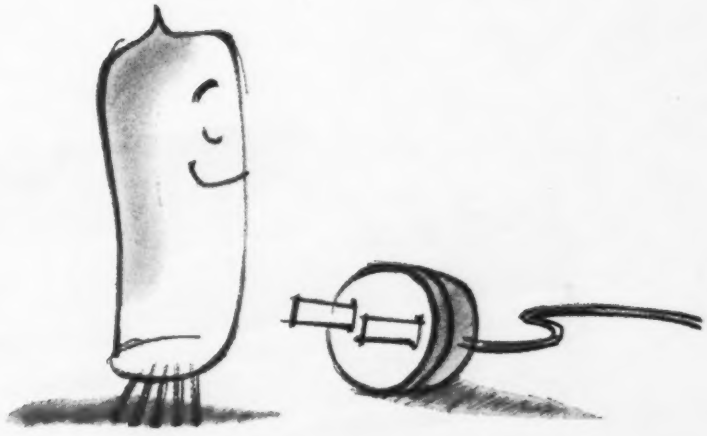
hold on, there!

you haven't heard the best news in distribution transformers until you get the whole story about the

LL-65

coming soon from Westinghouse

J-70963 -



"being electrical's all right — but *I'm* electronic"

Specialization is a great thing to get the right talents where they can do the most good. It's a good thing some people want to be mayors and some others would just as soon collect garbage.

But pride in your specialty can go to amusing extremes sometimes — like people in the "New Frontier" industries convincing themselves that their plateau is a little higher than anyone else's. Maybe it's only because there's more initial glamor associated with the new problems than the old familiar ones.

The E.E.'s at Fisher-Pierce work on both "electrical" and "electronic" jobs for every utility customer we have. They seem to rationalize things on the basis of whether it's milliwatts or kilowatts, Ohm's Law and plain figgerin' still pull out the answers. Got any hot new problems you'd like us to work on (electrical or that other kind)? Fisher-Pierce Division, Sigma Instruments, Inc., 82 Pearl St., So. Braintree 85, Massachusetts.

FP

FISHER PIERCE

CHEVROLET

SEEN IN ALL THE WORST PLACES

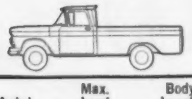
They keep showing up in places most trucks can't get to because it takes an awful lot to stop these sure-footed Chevy four-wheel-drive models! Where the job calls for the mobility of a mountain goat teamed with the stamina of a mule, you'll find no finer way to get your work done. And for 1961 the Chevrolet 4-wheel drive lineup is a full dozen models long. You can pick from a *wide* selection—one that's sure to include the best answer to your toughest traction-plus requirement!

■ Put any one of these 4-wheel drive Chevies on any job—then watch it dig in and *go!* Come what may in the way of mud, snow, sand, loose gravel, creek bottoms, swampland or freshly plowed ground, you can rest assured that the extra bite of up to double traction—plus stump-jumping road clearance—will get you through every time.

And you'll like the way a Chevy 4x4 rolls down the highway in smooth 2-wheel drive, ready to give you 4-wheel traction at the flick of a lever, the moment you need it. You'll appreciate the no-clutch shifting ease of the transfer case (whether moving or standing still) and the extra versatility that's yours with a choice of 4-wheel direct or underdrive.

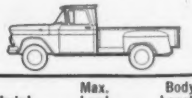
If you prefer the extra snap of spirited V8 power, it's yours at nominal extra cost in any model. Also available at extra cost are heavy-duty 3-speed and 4-speed transmissions and a wide choice of traction tires. You can tailor your Chevy 4 x 4 to fit your needs exactly. Get the full details and turn your traction problems over to Chevy—the traction champ of them all!... Chevrolet Division of General Motors, Detroit 2, Michigan.

FLEETSIDE



Model	Max. Load	Body Length
K1434	1400 lb.	6½′
K1534	1300 lb.	8′
K2534	2950 lb.	8′

STEPSIDE

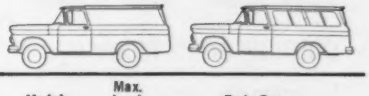


Model	Max. Load	Body Length
K1404	1450 lb.	6½′
K1504	1350 lb.	8′
K2504	3050 lb.	8′

CHASSIS-CAB

Model	Max. Load	Wheel-base
K1403	1900 lb.	115″
K1503	1850 lb.	127″
K2503	3500 lb.	127″

PANEL CARRYALL



Model	Max. Load	Body Type
K1405	1300 lb.	7½′ Panel
K1406	1000 lb.	Carryall (panel type rear doors)
K1416	1000 lb.	Carryall (tailgate and liftgate)

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PLEASE SEND COMPLETE INFORMATION ON THE CHEVROLET 4-WHEEL DRIVE LINEUP TO:

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Address_____

City_____ Zone_____ State_____

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Chevrolet Motor Division
General Motors Corporation
Detroit 2, Michigan

39

1961 CHEVROLET STURDI-BILT TRUCKS

CHEVROLET

heard the one about the

happy utility executive?
he's heard about a new
distribution transformer

LL-65

coming soon from
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J 70963-5

Monday Named HAPCO Division Vice President

Hubbard & Co has elected John C. Monday vice president and general manager of the Hubbard Aluminum Products Co division, Pittsburgh, Pa.

He will have responsibility for production, sales, engineering, and related functions of the division.

Monday was manager of Hevi-Duty Electric Co's regulator division before joining Hubbard two years ago.

FANTE PARKER

Fante and Parker Become Executive Vice Presidents

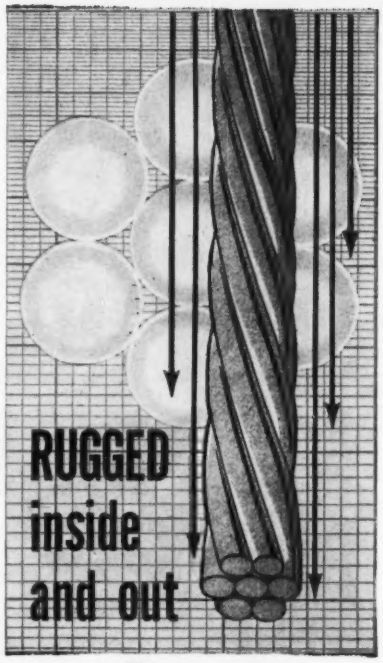
Harry Fante and F. W. Parker Jr have become executive vice presidents of Rockwell-Standard Corp.

Fante has long been a vice president and director of Rockwell-Standard. Parker has for many years been vice president in charge of the company's largest operating division, the transmission and axle group. He is also a director.

Georgia Public Service Head McWhorter Retires

Matthew L. McWhorter has retired as chairman of the Georgia Public Service Commission. He was a member of the commission for 25 years and served many years as chairman.

(*More News About People, p* 93)



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Crapo Galvanized Steel Strand is economical, too, both in first cost and ultimate cost.

A B C

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A coating weight for every need—***Crapo*** Galvanized Steel Strand is readily available in Class A, B and C weights of coating. Class B coating is twice as heavy as the standard Class A coating; Class C coating is three times as heavy.

Contact the distributor of *Crapo* Galvanized Steel Strand near you for complete information!

INDIANA
Steel & Wire Co., Inc.
Muncie, Indiana

LET'S KEEP

Business Help For Our Colleges Going Full Speed Ahead

"Should our company fold up its program of financial help for higher education now that the Kennedy Administration plans to have the federal government provide this kind of help in a big way?" It is clear why, in the light of campaign promises and plans announced since, this question is being raised in many business firms at this juncture.

What seems far clearer, however, is the right answer to the question. It is a resounding NO! **This is no time for the business community to ease up in what have been its notably successful efforts to help our colleges and universities get out of the deep financial hole in which they are operating. On the contrary, this is the time to put more steam than ever behind the drive of business to increase its financial help for higher education.**

Massive Help Needed

It is easy to understand why any individual businessman or firm might have a rather despairing feeling about the prospect of competing with the federal government, with its almost all-embracing tax arm, in providing financial support for higher education or almost anything else for that matter. But this is not a case of competition. It is a case where our colleges and universities must have massive help all along the line if they are to be put squarely back on their feet financially—a goal of crucial and perhaps decisive national importance. **The business community will continue to have both the opportunity and the obligation to keep on increasing its help for higher education as rapidly as possible.**

To underline this proposition take a look at the chart at the top of the next page. It shows how far the salaries of college and university faculty members continue to lag behind those of other occupational groups in the U.S.A. There has been some relative improvement in the average of faculty salaries in recent years. And the salary improvement in some fields, such as those of science and mathematics, has been very pronounced. But the chart makes clear how badly the average salary of college and university faculty members still lags.

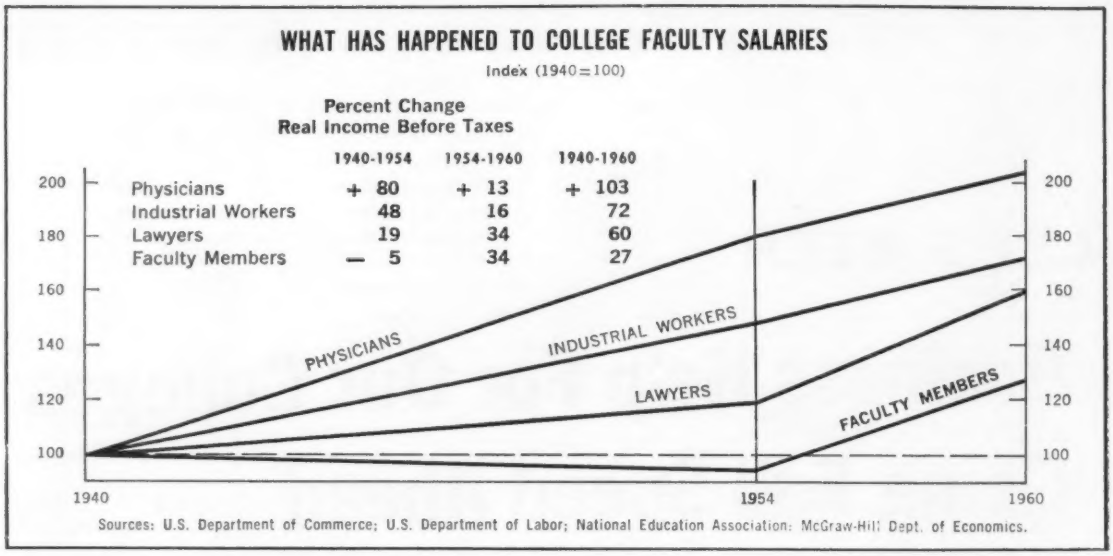
No Federal Funds For Salaries

The plans for increased financial aid for higher education, proposed by President Kennedy, do not contemplate increased expenditure for faculty salaries. This, we believe, is wise whether or not you feel, as many do, that resort to this kind of federal financing would inevitably carry with it federal controls that would ultimately undermine academic independence. The fight over federal appropriations for faculty salaries would be so long and bitter that it would be destructive to the aid program as a whole.

However, what the federal government will not be doing to remedy the deplorable condition of faculty salaries, as reported by the chart, is one indication of the tremendous scope that remains for crucially important help for higher education from business. Manifold other indications are available.

Disaster Escape Route

One of these indications is provided by the careful calculation that the annual income of our colleges and universities must be increased by about $4½ billion (from about $4½ billion to about $9 billion) over the next eight years if the tremendous wave of students



now gathering to descend on these institutions is not to wind up in both a financial and an educational disaster. This wave promises to add more than 2.5 million, or 75%, to college enrollments by 1970.

Thus far, the program for financial help for higher education by business, spearheaded by the Council for Financial Aid to Education, has been a remarkable success in all dimensions. The dollars contributed have increased rapidly—from about $100 million five years ago to about $150 million this year. Contributions of $500 million a year by 1970 are a clear possibility.

One of the inspiring developments increasing this possibility stems out of Cleveland, Ohio. There through their chief executives, an imposing group of business firms have established one per cent of their profits before taxes as their minimum goal for contributions to higher education, to be reached within three years. General acceptance of this goal by business would go most of the way toward getting our colleges and universities firmly on their feet financially.

Mutual Respect Increased

The mutual esteem of the academic community and the business community, an element of enormous importance to a free society, has been increased by the manner in which the program of financial aid has been carried out. In making its contribution, there has been no attempt whatsoever on the part of business to encroach upon the academic freedom of the institutions financially benefited. And the program of financial aid has greatly increased the knowledge, understanding and respect which the colleges and universities and business have for each other.

The Kennedy Administration's program to enlarge federal financial support of higher education is certain to arouse strenuous controversy. As proposed by its Task Force, it avoids some of the most controverial areas of principle. However, the very magnitude of the proposed extension of the federal government's already vast program of financing higher education involves fighting issues.

But if the enlargement of federal aid were to be deeply discouraging to the continued expansion of private aid for higher education, it would be a national misfortune of major proportions. There is no good reason why it should be. On the contrary, there is compelling reason for the business community to continue giving higher education all the financial help it possibly can, thus speeding onward a program that has been and continues to be a major constructive force for our colleges and universities, for business and for the nation.

This message was prepared by my staff associates as part of our company-wide effort to report on major new developments in American business and industry. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or part of the text.

Donald C. McGraw

PRESIDENT

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OBITUARIES

Edward M. Graham Sr, 72, chairman of Bangor Hydro-Electric Co . . . **R. G. Kenyon,** former vice president of Southern California Edison Co . . . **Walter I. Lukenbill,** 66, retired vice president of Louisville Gas & Electric Co.

Russell H. Wheatley, 64, assistant vice president of Brockton (Mass.) Edison Co . . . **Charles F. Daugherty,** 56, commercial and industrial sales supervisor for the Fort Wayne division of Indiana & Michigan Electric Co.

Floid M. Fuller, 77, retired distribution manager of Pennsylvania Power & Light Co . . . **Eugene A. Barth,** 71, former assistant to the president of Wisconsin Power & Light Co.

Dwight H. Marsh, 59, president of Champion Lampworks of Lynn, Mass. . . . **Thomas F. Eynon,** 79, founder and treasurer of Penn Electrical Engineering Co . . . **H. A. Renholm,** 61, staff VP, central region, distributor and commercial relations, Radio Corp of America . . . **Grant H. Potter,** 61, former senior partner of Charles A. Maguire & Associates of Providence.

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EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

Manufacturers Briefs

(*Continued from page* 65)

on the boiler's annual fuel costs.

When placed in operation, the Ljungstrom preheaters will receive incoming air at 80F and preheat it for combustion to about 575F. To accomplish this, the heating elements are rotated through exhaust gases being emitted from the boiler at 660F and then into the incoming combustion air stream.

• **Onan Div of Studebaker-Packard Corp,** manufacturer of electric generating plants, has opened a new technical center in Minneapolis, Minn., where basic research into fuel cells is already under way. Operation of the center, set up principally for study and development of air-cooled engines and generators, will be under the direction of James C. Hoiby, engineering vice president. The fuel cell project is headed by T. G. Valenty, manager of development engineering.

• **Delta-Star Electric Div** of H. K. Porter Co Inc recently announced a new distribution transformer with a completely new core design, and an aluminum strip low-voltage winding. Advantages of the new design include lower weight, reduced hot spots, increased short circuit strength, and longer life. The aluminum strip low-voltage winding varies in width from approximately 6-in. on the smallest kva's to 15 in. on the larger sizes. The broad surface of the aluminum strip keeps temperature gradients to a minimum. Hot spots are minimized. The aluminum strip balances ampere-turn distribution between high and low-voltage windings. Because of this, axial (vertical) forces are practically eliminated, enabling these units to withstand higher short-circuit currents than conventional copper-wire designs. By drastically reducing the axial forces, insulation life is prolonged.

Strip winding, because of its simplicity, is much more suitable for automated winding than conventional layer wound coils. To automate this and other transformer production facilities, Delta-Star recently built a completely new plant at Lynchburg, Va. Early June production is planned for several ratings of the new transformers and full production on the complete line is scheduled for Sept., 1961.

count the dollars

you can save if you'll wait for the new distribution transformer

LL-65

coming soon from Westinghouse

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Transmission - Distribution
Electric and Telephone Lines
Consultants
505 York Road — Jenkintown, Pa.

DOBLE ENGINEERING COMPANY
Consulting Engineers
Field and Laboratory Testing of Solid and Liquid High Voltage Insulation. Research on Power System Electrical Operating Characteristics and Problems.
Office and Laboratory: Doble Park
Box 105, Belmont 78, Mass. (6 miles from Boston)

JENSEN, BOWEN & FARRELL
Engineers
Appraisals—Depreciation Studies—Property Records
Cost Trends—Special Studies—Reports
for Rate Cases, Security Issues, Regulatory and Accounting Requirements
Michigan Theatre Building Ann Arbor, Michigan
NOrmandy 8-7778

VERNON GRAPHICS, INC.
Mount Vernon, N. Y.
MO 4-7117

VERNON GRAPHICS OF PA. INC.
Norristown, Pa.
Broadway 9-3000

CONSULTING AND SERVICING UTILITIES ON MAPS, RECORDS AND FIELD INVENTORY

GIBBS & HILL, Inc.
Consulting Engineers—Designers—Constructors
Steam, Hydroelectric, Gas-Turbine & Nuclear Power Generation—Electric Transmission & Distribution Systems—Power Surveys, Reports & Contracts—Industrial, Transportation & Communication Facilities—Water & Waste Treatment Works.
Pennsylvania Station — New York 1, N. Y.

THE KULJIAN CORPORATION
Engineers - Constructors - Consultants
POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)
Utility • Industrial • Chemical
1200 N. Broad St., — Philadelphia 21, Pa.

A. W. WILLIAMS INSPECTION CO., INCORPORATED
Specialized Inspection Service
Poles, Crossarms, Lumber, Piles, Crossties
Preservative Treatment and Preservative Analysis
205 Virginia St., Mobile, Ala.
New York — St. Louis — Portland
Inspectors stationed throughout the U.S.A.

CLASSIFIED **SEARCHLIGHT SECTION** ADVERTISING

EMPLOYMENT • BUSINESS • **OPPORTUNITIES** • EQUIPMENT—USED or RESALE

DISPLAYED RATE:

EMPLOYMENT OPPORTUNITIES: $25.50 per inch. Subject to Agency Commission.
EQUIPMENT & BUSINESS OPPORTUNITIES: $16.85 per inch for all advertising appearing on other than a contract basis. Not subject to Agency Commission.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

RATES

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$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

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BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

Send New Advertisements to Classified Advertising Div. of Electrical World, P. O. Box 12, N. Y. 36, N. Y.

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFG.	VOLTAGE
1	12000	G. E.	115,000—46,000 L. T. C.
1	10000	West.	67,000—34,500, 3 Ph. Auto.
1	7500	West.	66,000—13,800, 3 Ph.
1	3750	G. E.	69,300—13,200, 3 Ph.
1	3000	G. E.	69,000—4340, 3 Ph.
6	1667	West.	66,000—2300/4000
3	1250	G. E.	69,300—2400/4160
6	750	Wagner	66,000Y—13,200
4	333	West.	67,000—7200/12470Y
2	2500	Wagner	45,000—4160Y, 3 Ph.
1	5000	West.	34,500—13750/6875, 3 Ph.
1	4500	West.	33,000—2500/4330, 3 Ph.
3	3333	Penna.	34,500—6900/11950Y
2	3000	Upef.	34,750—4160, 3 Ph.
2	1500	G. E.	34,400—2520, 3 Ph.
3	1250	A. C.	33,000—480
4	750	Wagner	33,000Y—6900
3	500	Mol.	34,500—2300/4600
3	200	A. C.	34,500—2400/7200/12470Y
2	3000	G. E.	26,400—4160Y/2400, 3 Ph.
1	3750	West.	22,900—4160Y, 3 Ph.
2	3000	G. E.	13,800—2640, 3 Ph.
1	2500	G. E.	13,800—2400, 3 Ph. Unit Sub.
3	667	G. E.	13,200—240/480
1	600	Stand.	13,200—2300, 3 Ph.
1	450	Penna.	13,200—2400, 3 Ph. Askarel
1	4500	West.	7,245—2300, 3 Ph.
1	1000	A. C.	2,400/4,160—240, 3 Ph.
3	400	G. E.	2,300/4,000—230/460

FREQUENCY CHANGERS

1 4600 Kw, 60 cycle, 13800 volts, Generator
6500 Hp, 25 cycle, 11000 volts, Motor—300 Rpm
1 2500 Kw, 25 cycle, 2400 volts, Generator
3500 Hp, 60 cycle, 6600 volts, Motor—300 Rpm
1 2000 Kw, 62½ cycle, 2300/4000 volts, Generator
2800 Hp, 25 cycle, 2300/4000v, Motor—750 Rpm

Also: CIRCUIT BREAKERS, SWITCHGEAR FEEDER REGULATORS, M-G SETS, ETC.

BREW, WOLTMAN
& CO., INC.
52 Church Street, New York 7, N. Y.

TRANSFORMERS

3—2500 KVA G-E 69000—2400/4160Y
3—2500 KVA G-E 69000—7200/12470Y
4—2500 KVA W-H 34500—2400/4800
3—1500 KVA G-E 69000—2400/4160Y
3—1500 KVA G-E 69000—7200/12470Y
4—1000 KVA Mol 7200/12470Y—4160
3—1000 KVA G-E 34500-7200/12470Y
3— 500 KVA G-E 34500-2400/4160Y
3— 833 KVA W-H 43800—480
3— 667 KVA G-E 13800—2400
3— 333 KVA W-H 13200—2400/4160Y
3— 333 KVA G-E 2400/4160Y—240/480
3— 333 KVA Wag. 2400—120/240
1—1500/1875 KVA Mol. 3-Ph. 40,500—4800 F/C equipped
1—1500/1875 KVA Mol. 3-Ph. 34,500—2400 F/C equipped

TRANSFORMERS WANTED

THE ELECTRIC SERVICE CO.
5316 Hetzel St.
Cincinnati 27, Ohio
47 Years' Dependable Service

ADDRESS BOX NO. REPLIES TO: Box No.
Classified Adv. Div. of this publication.
Send to office nearest you.
NEW YORK 36: P. O. Box 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 11: 255 California St.

POSITION VACANT

Electrical Engineer—Excellent opportunity for graduate engineer to enter consulting field and grow with progressive Midwest concern. Board layout work—power, lighting, and control systems; calculations; and occasional field contacts. 3-5 years experience. Moving expenses paid. Send resume, including education, experience, and personal qualifications to P-6246, Electrical World.

BECHTEL

Power Plant Supervisor

Foreign Employment KOREA

With at least 3 to 5 years recent experience as supervisor of operations and maintenance of steam electric generating plant with some experience in operations of a coal fired plant.

NO FAMILY HOUSING
Send resume to Personnel Manager

BECHTEL CORPORATION
220 Montgomery Street
San Francisco, Calif.

ELECTRICAL ENGINEER

Excellent opportunity for electrical engineer as consultant to client in Far East. Must have thorough experience in electric utility system operation. Two-year contract subject to renewal. Overseas salary $1,500 per month plus allowances for housing and subsistence. Fringe Benefits. Send resume to Personnel Manager.

HARZA ENGINEERING COMPANY
400 West Madison Street, Chicago 6, Illinois

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-5579) will be received at Denver, Colorado, until 2 p.m., Mountain Standard Time, June 1, 1961, for furnishing generator-voltage bus structure, low-voltage feeder busways, station-service transformers and switchgear assemblies for Clear Creek Powerplant, Central Valley Project, California. Delivery is desired within 330 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 25, Colorado. Floyd E. Dominy, Commissioner.

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Address Classified
Advertising Division

ELECTRICAL WORLD

P. O. BOX 12

NEW YORK 36, N. Y.

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.

Meetings Calendar

MAY

Edison Electric Institute—Electrical System & Equipment Committee, Hotel Roosevelt, N. Y., May 15-16; Transmission & Distribution Committee, Netherland-Hilton Hotel, Cincinnati, May 18-19; Commercial Cooking Conference, Chicago, May 23; Street & Highway Lighting Committee, Corning, N. Y., May 24-25.

• **American Right-Of-Way Association** — Seventh Annual National Seminar, Olympic Hotel, Seattle, Washington, May 16-18.

American Institute of Electrical Engineers—North Eastern District Meeting, Statler Hotel, Hartford, May 17-19; Fractional Horsepower Motors Conference, Biltmore Hotel, Dayton, May 23.

• **Pacific Coast Electrical Association**—Annual Convention, Sheraton-Palace Hotel, San Francisco, May 17-19.

Pennsylvania Electric Association—Systems Operation Committee, Skytop, Pa., May 18-19; Street & Highway Lighting Committee, Wellsboro, Pa., May 18-19; Accounting Conference, Penn Sheraton, Pittsburgh, May 22-23; Customer Relations Conference, Hotel Hershey, Hershey, Pa., May 23-24; Relay Committee, Skytop, Pa., May 25-26; Motor Transportation, Hershey, Pa., May 25-26.

• **National Symposium on Global Communications**—Sponsored by AIEE-IRE, Sherman Hotel, Chicago, May 22-24.

• **American Society of Mechanical Engineers**—Design Engineering Conference, Cobo Hall, Detroit, Michigan, May 22-25.

• **Northwest Electric Light & Power Association**—Accounting & Business Practice Section, Medford Hotel, Medford, Ore., May 24-26.

• **Electric Council of New England**—Electrical System & Equipment Meeting, Pelham Club, Dennisport, Massachusetts, May 25-26.

• **Great Lakes Power Club**—Spring Meeting, Statler Hilton Hotel, Detroit, May 25-26.

• **Great Lakes Conference of Railroad & Utilities Commissioners**—Greenbrier Hotel, White Sulphur Springs, W. Va., May 28-31.

JUNE

• **Oregon Washington & Idaho Tri-State Cooperative Meeting**—Shore Lodge, McCall, Idaho, June 1-3.

• **ECAP**—Management Group, Hotel Pierre, N. Y. C., June 4.

• **Electric Companies Public Information Program** — Steering Committee Meeting, Teakwood Room, The Pierre, New York City, June 4.

• **Edison Electric Institute**—Annual Convention, Waldorf Astoria, New York City, June 5-7.

• **Instrument Society of America**—Summer Instrument-Automation Conference and Exhibit, Royal York Hotel & Queen Elizabeth Hall, Toronto, Ontario, Canada, June 6-8; Air Pollution Instrumentation Symposium (with the June 11-15 Annual Meeting of the Air Pollution Control Association), Hotel Commodore, New York City, June 12.

• **Pennsylvania Electric Association**—Joint Meeting of Stores Committee & Purchasing Committee, Connellsville, Pa., June 8-9; Personnel Practices, Hershey, Pa., June 22-23; General & Customer Accounting Committee, Bedford Springs Hotel, Bedford, Pa., June 22-23; Customer Contact Committee, Erie, Pa., June 23; Industrial Committee, Penn State, Pa., June 23; Taxation Committee, Pittsburgh, June 26-27; Plant Accounting & Records Committee, Allenbury, Pa., June 29-30.

• **Wisconsin Utilities Association**—Accounting Conference, Dell View Hotel, Lake Delton, Wisconsin, June 11-13.

• **Wisconsin Municipal Utilities Association**—Annual Conference, Imhoff's, Lake Delton, June 11-13.

• **American Society of Mechanical Engineers**—Semi-Annual Meeting, Statler Hilton Hotel, Los Angeles, June 11-15.

• Additions this week.

Advertising Index

Allen-Bradley Co. 19, 20
Allis-Chalmers Mfg. Co. 2nd Cover, 39, 40
Aluminum Co. of America Structural Div. 62, 63

Bethlehem Steel Co. 38
Buffalo Forge Co. 34

Chance Co., A. B. 33
Chevrolet Div. General Motors Corp. 88, 89
Circle Wire & Cable Corp. 27
Copperweld Steel Co. 11

Directory of Engineers 94

Edison Industries, Thomas A. Instrument Div. 26
Electric Machinery Mfg. Co. 36, 37
Engineers, Directory of 94
English Electric Co., Ltd. 16
Everstick Anchor Co. 93

Fargo Mfg. Co., Inc. 57
Fisher-Pierce Div. Sigma Instruments, Inc. 87

G&W Electric Specialty Co. 80
General Electric Co.
Apparatus Dept. 72
Computer Dept. 70, 71

Holan Sub. Ohio Brass Co. 14, 15

Indiana Steel & Wire Co., Inc. 90

Joslyn Mfg. & Supply Co. 35

Kuhlman Electric Co. ..... 4th Cover

Lapp Insulator Co., Inc. 30, 31

Minneapolis-Honeywell 64
Moloney Electric Co. 61
Motec Industries, Inc. 28, 29

National Electrical Contractors Ass'n. 69

Ohio Brass Co. 25
Okonite Co. 4

Pennsylvania Transformer Div. McGraw-Edison Co. 8
Pitman Mfg. Co. 9
Plastoid Corp. 18

Reynolds Metals Co. 32
Rome Cable Div. of Alcoa ..... 3rd Cover

Sangamo Electric Co. 65
Searchlight Section 95
Shell Oil Co. 7
Sierra Electronic Corp. 6
Sikorsky Aircraft Div. United Aircraft Corp. 83, 84, 85
Simplex Wire & Cable Co. 17
Southern States Equipment Corp. 12, 13

Wagner Electric Corp. 66, 67
Westinghouse Electric Corp. 64, 68 77, 78, 79, 82, 87, 90, 93
Willys Motors, Inc. 10

PROFESSIONAL SERVICES 94

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 95

EQUIPMENT
(Used or Surplus New)
For Sale 95

EHV-We're ready when you're ready!

One of Alcoa's newest conductors, 2.32 inches in diameter, is the largest ever used for overhead transmission. It is installed on the Penelec experimental 460-kv transmission line energized in October of 1960.

Cable of the same diameter, but of a slightly different design, is installed on General Electric's Project EHV (pictured below) in Pittsfield, Mass. Energized at a nominal voltage of 500 kv, this conductor is the first to be tested on this project.

Participation in such current projects is part of Alcoa's continuous preparation for the future. Historically, Alcoa has been involved in nearly all extra-high-voltage test projects.

Consequently, Alcoa has manufactured conductor for more than 2000 of the nation's 2450 commercial EHV circuit miles energized at 345 kv or higher.

Ready for EHV? We've been ready since 1913, when Alcoa pioneered ACSR to carry 220 kv. And we'll be ready any time you are.

ALCOA
ROME CABLE
DIVISION

Gold transformer on the pole...
Gold Medallion on the home...

The perfect team for stronger identification of your total electric homes!

Most exciting development in residential building today is the total electric home—with clean, comfortable, practical electric heat. Its growing acceptance reveals the greatest load builder for utilities in the next decade.

Help home-seekers identify the total electric homes they are looking for by using the two symbols that are recognized as marking all-electric electric-heated homes. Use the Kuhlman gold transformer on the pole that serves the home. It can be seen from a distance and is a gleaming symbol of value. Display the industry's Gold Medallion prominently on the home, too, to take advantage of the prestige of this nationally known symbol.

Use this distinctive pair to get identification and traffic for your showplace electric-heated homes. The Gold Medallion and the Kuhlman gold transformer!

KUHLMAN TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Michigan

Manufacturers of transformers since 1894

FACTORIES: Bay City, Mich. • Crystal Springs, Miss. • Salinas, Calif.